OutBack Power Systems

"Export" FX and VFX Inverter/Charger

Installation and Programming Manual

Document Revision 7.1

FX 2012ET - 2.0 kW / 12 VDC / 230 VAC / 50 Hz *(Sealed + Turbo / Export)*

FX 2024ET - 2.0 kW / 24 VDC / 230 VAC / 50 Hz *(Sealed + Turbo / Export)*

FX 2348ET - 2.3 kW / 48 VDC / 230 VAC / 50 Hz *(Sealed + Turbo / Export)*

VFX 2612E - 2.6 kW / 12 VDC / 230 VAC / 50 Hz *(Ventilated / Export)*

VFX 3024E - 3.0 kW / 24 VDC / 230 VAC / 50 Hz *(Ventilated / Export)*

VFX 3048E - 3.0 kW / 48 VDC / 230 VAC / 50 Hz *(Ventilated / Export)*

The "Sealed" version of the FX

The "Vented" version of the FX

The "Turbo Kit" that comes with the FX "ET" series is shown on page 17

Please check our website at www.outbackpower.com for the latest product information

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EU Declaration of Conformity

According to ISO / IEC Guide 22 and EN 45014

Product Type: Power Inverter/Charger

Product Model Numbers: FX2012E, VFX2612E, FX2024E, VFX3024E, FX2348E, VFX3048E,

These products comply with the following EU directives:

Electromagnetic Compatibility 89/336/EEC, "Council Directive of 3 May 1989
On the approximation of the laws of member States relating to Electromagnetic compatibility"

Low Voltage Directive 73/23/EEC, "Council Directive of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment for use within certain voltage limits"

The compliance of the above mentioned products with the directives and the following essential requirements is hereby confirmed when installed off-grid.

Emissions and Immunity	Safety
EN 61000-3-2: 2000	EN 60950-1: 2002
EN 61000-6-3: 2001	
EN 61000-6-1: 2001	
EN 61000-3-3: 1995	

All associated technical files are located in the Engineering Department at OutBack Power Systems Inc., Arlington, Washington, USA.

As the manufacturer we declare under our sole responsibility that the above mentioned product complies with the above named directives.

Robin Gudgel
President

Arlington, WA, USA 03-August-2003
Place and Date

OutBack Power Systems

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Installation Guidelines

This manual contains important instructions for the OutBack FX "Export" (or "E") series inverter/charger system with the software which allows parallel and 3-phase stacking of multiple units for higher power and/or higher voltage systems.

1 **All of the AC field wiring terminals are to be torqued to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm)**. Wiring to these terminals must meet requirements of the local electric code. The terminals will accept up to 6AWG (13.3mm^2). Use copper conductors only with insulation rated for 75˚ C. See the AC WIRING CONNECTIONS section of this manual for more information.

2 **Torque the DC connections to 60 inch-pounds (equivalent to 5 foot-pounds or 6.8 Nm).** Cables to these terminals must use a crimp on type ring terminal or compression type lug. Cable must meet the requirements of the National Electrical Code. Use of large gauge cables {2/0 AWG (68mm^2) or 4/0 AWG (107mm^2)} or larger is advisable to reduce losses and ensure high performance of the FX. Cables of too small a gauge can result in poor performance and even damage the FX. Keep the cables together as much as possible and ensure that both cables pass through the same knockout and conduit fittings and to allow the inductive currents to cancel.

3 For equipment grounding hook up, see wiring instructions in this manual. This product is intended to be installed as part of a permanently grounded electrical system.

4 AC overcurrent protection for all connections must be provided by others as part of the installation.

5 DC battery circuit overcurrent protection must be provided by others as part of the installation.

OutBack offers 100, 175 and 250 amp DC breakers (part number OBDC-XXX) which can be used with the FX. OutBack also offers a stud mounted fuse which can be connected directly to the positive DC terminal of the FX – it is available in 100, 175 and 250 amp sizes (part number SMF-XXX) The Stud mounted fuses require a 10mm hole in the battery terminal lug. US lugs are typically 3/8" diameter. Light filing may be required to insure proper fit of the nut shoulder into the lug hole.

6 The equipment ground on the inverter is marked with this symbol:

7 This inverter has a single phase output. It is marked with this symbol:

8 This inverter puts out a sine wave waveform. It is marked with this symbol:

9 **CAUTION:** To reduce the risk of fire, connect only to a circuit provided with 30 amp maximum branch-circuit overcurrent protection.

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General Precautions

1. Before using the FX, read all instructions and cautionary markings on (1) the FX, (2) the batteries and (3) all appropriate sections of this installation and operation manual.
2. **CAUTION** - To reduce risk of injury, charge only deep-cycle lead acid, lead antimony, lead calcium, gel cell or absorbed glass mat type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
3. The FX is approved for indoor mounting only in any position.
4. Do not disassemble the FX. Refer servicing to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
5. To reduce risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning. Turning off the FX may not reduce this risk. Solar modules may produce hazardous voltages when exposed to light - cover them with opaque material before servicing any connected equipment.
6. **WARNING** - **WORKING IN THE VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION**. Provide ventilation to outdoors from the battery compartment. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen gas in "pockets" at the top of the enclosure. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow of hydrogen to the vent opening at the highest possible location.
7. NEVER charge a frozen battery.
8. No terminals or lugs are required for hook-up of the AC wiring. AC wiring must be copper wire and rated for 75°C or higher. Battery cables must be rated for 75°C or higher. Crimped and sealed copper ring terminal lugs with a 5/16"-3/8" (8mm-10mm) hole should be used to connect the battery cables to the DC terminals of this FX. Soldered cable lugs are also acceptable.
9. **Torque all AC wiring connections to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).**
10. **Torque the DC connections to 60 inch-pounds (equivalent to 5 foot-pounds or 6.8 Nm).**
11. Be careful with tools to reduce the risk of dropping metal objects onto batteries. It may short-circuit the batteries or other electrical parts resulting in fire or explosion.

Additional Notices

1. For instructions on mounting, see the MOUNTING section of this manual.
2. For battery installation and maintenance: read the battery manufacturer's instructions prior to installation and operation.
3. All installations must comply with local and national electrical codes and standards.
4. **GROUNDING INSTRUCTIONS** - This FX should be connected to a grounded, permanent wiring system. For most installations, the negative battery conductor should be bonded to the grounding system at one (and only one point) in the system. All installations should comply with national and local codes and ordinances.

Personal Precautions While Working with Batteries

1. Someone should be within range of your voice to come to your aid.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye protection. Avoid touching eyes while working near batteries. Wash your hands with soap and water when done.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cool water for at least 15 minutes and get medical attention immediately.
5. Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries.
6. **NEVER** smoke or allow a spark or flame in vicinity of a battery or generator.
7. Be extra cautious to reduce the risk of dropping a metal tool onto batteries. It could short-circuit the batteries or other electrical parts that may result in fire or explosion.
8. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short-circuit current high enough to weld a ring or the like to metal, causing severe burns.
9. If a remote or automatic generator start system is used, disable the automatic starting circuit and/or disconnect the generator from its starting battery while servicing it to prevent starting while servicing.

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NOMINAL SYSTEM AC VOLTAGE:

This is the AC output voltage produced by an FX system. Each FX produces 230 VAC (volts of AC) but multiple FXs can be configured in parallel or 3-phase and these configurations may produce different voltages on the AC output legs.

Single Phase	230 VAC at 50 Hz (VAC = volts AC, Hz = Hertz)
Parallel Stacked	230 VAC at 50 Hz on one AC output leg
Three Phase	230 VAC at 50 Hz per AC output leg (limit three)/400 VAC at 50 Hz between AC output legs

RECOMMENDED DC VOLTAGE RANGE:

This is the DC battery voltage range to be used for operating the FX. The last two digits in the model number designate the nominal DC voltage. Example: FX20**24**MT **–** 24V DC Voltage.

12V Systems	11 – 16 VDC (VDC = volts DC)
24V Systems	22 – 32 VDC
48V Systems	44 – 64 VDC

MAXIMUM DC INPUT CURRENT:

This is the maximum DC current that the FX will draw from the battery when starting very large AC loads. It is not used for sizing the DC disconnect or selecting DC cable gauge. It is used to select the minimum reasonable battery capacity.

12V FX's	600 ADC per FX (ADC = amps DC)
24V FX's	300 ADC per FX
48V FX's	150 ADC per FX

RATED DC INPUT CURRENT:

This is the maximum continuous DC current that the FX will draw from the batteries when inverting.

FX2012E	190 ADC (ADC = amps DC)
FX2024E	95 ADC
FX2348E	55 ADC
VFX2612E	250 ADC
VFX3024E	145 ADC
VFX3048E	70 ADC

AC INPUT OPERATING VOLTAGE RANGE:

This is the recommended AC input voltage range to be supplied to the FX. Voltages outside of this range may damage AC loads connected to the FX's AC output terminals.

All "Export" FX's	200 - 260 VAC (VAC = volts AC)

MAXIMUM AC INPUT CURRENT:

An AC input source connected to the FX supplies power for two separate internal AC circuits – the AC transfer switch and the battery charging system. The AC transfer switch transfers the AC input power through the FX to the AC loads connected to the AC output of the FX. The FX's battery charger will "back off" when the combined amperage of the AC loads and the battery charger exceeds the programmed AC input current limit (default of 24 AAC). This "Input Limit" can be adjusted so as not to overload a generator or trip a breaker that is connected to the AC input of the FX. If your generator cannot produce 24 AAC or you are connecting to an AC input source that has a breaker that is rated for less than 30 AAC, please refer to the programming section to change this setting.

All "Export" FXs	30 AAC per FX (AAC = amps AC)

MAXIMUM CURRENT FOR BATTERY CHARGER:

The FX uses AC current from the AC input source to charge the battery. Due to heat constraints, the FX limits this amount of current. The maximum and default values for this setting are shown below. Please refer to the programming section to adjust this setting. The battery charger has an efficiency of 90%. There are other factors like cable losses that may reduce this efficiency. The maximum DC current that can be produced is also shown below. These maximum DC currents can only be attained in the "Bulk" charging stage.

FX2012ET	AC Max = 6 AAC (Default = 5 AAC)	DC Max = 100 ADC
FX2024ET	AC Max = 7 AAC (Default = 6 AAC)	DC Max = 55 ADC
FX2348ET	AC Max = 7 AAC (Default = 6 AAC)	DC Max = 35 ADC
VFX2612E	AC Max = 8 AAC (Default = 7 AAC)	DC Max = 125 ADC
VFX3024E	AC Max = 10 AAC (Default = 9 AAC)	DC Max = 85 ADC
VFX3048E	AC Max = 10 AAC (Default = 9 AAC)	DC Max = 45 ADC

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AC INPUT FREQUENCY RANGE:

This is the AC input source's frequency range that the FX will accept and stay connected. If the AC input source is out of this range, the FX will not connect or stay connected.

All "Export" FXs 45 - 55 Hz

MAXIMUM AC OUTPUT CURRENT:

This is the amount of "Surge" current that the FX will supply. This amount of surge can only be supplied for a split second. After this split second the FX lowers this surge limit. Depending on the size of the surge, the FX can be overloaded for a minimum time of 5 seconds to a maximum time of 30 minutes. When passing an AC source through the FX via the AC transfer switch, the maximum AC output fault current will be determined by the AC source.

All "Export" FXs 25 AAC per FX for 1 millisecond

MAXIMUM CONTINUOUS OUTPUT POWER:

Each FX has a maximum continuous output power it can deliver. This maximum continuous output power is hidden in the model number of the FX. For instance, an FX**2012**MT has a maximum continuous output power of 2000VA (volt-amps). The last two numbers (12 in this case) can be changed to 0's because they refer to the battery voltage.

FX2012ET	2000 VA (VA = volt-amps)
FX2024ET	2000 VA
FX2348ET	2300 VA
VFX2612E	2600 VA
VFX3024E	3000 VA
VFX3048E	3000 VA

MAXIMUM OVERCURRENT PROTECTION AMPACITY:

This rating specifies the proper overcurrent protection ampacity. OBDC are panel mount circuit breakers. FX's used in home installations should use properly sized DC circuit breakers. DC breakers include both overcurrent protection and disconnect capability.

MODEL	AMPACITY	DC BREAKER
FX2012ET	250 amps	OBDC-250
FX2024ET	175 amps	OBDC-175
FX2348ET	100 amps	OBDC-100
VFX2612E	250 amps	OBDC-250
VFX3024E	250 amps	OBDC-250
VFX3048E	175 amps	OBDC-175

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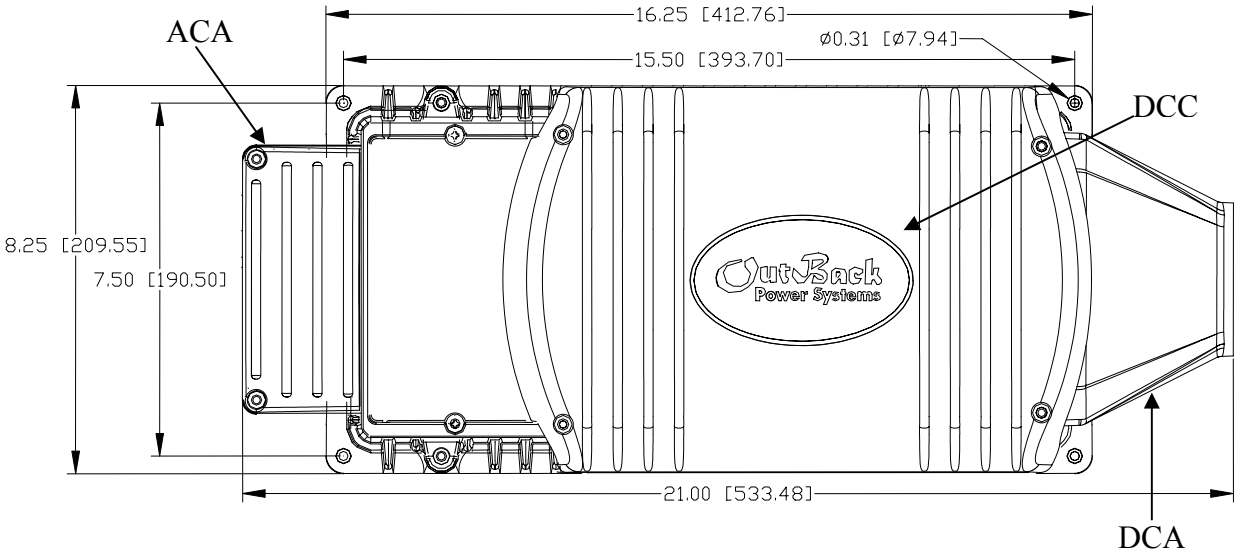
All OutBack FX's can be mounted in any position. Better performance will be achieved if it is mounted in a location which allows for air to circulate around the exterior of the casting. Locating the FX in a cool location will improve the operation and ensure the highest efficiency and power capacity.

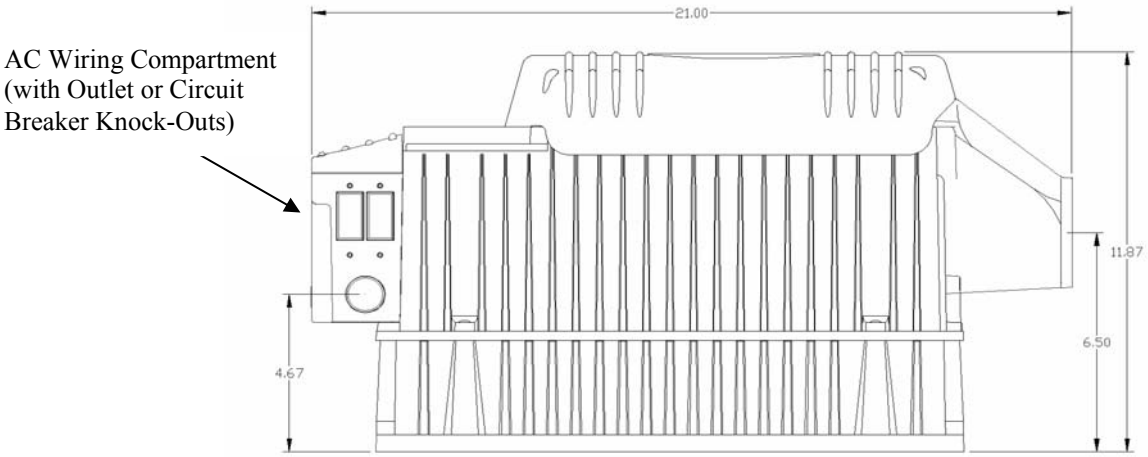
The following drawing provides the mounting and overall dimensions of the FX with the FXA kit (DCC + ACA + DCA) attached. The first dimension is inches and the second value in parenthesis is the metric value in millimeters.



Depth out from Wall / Height up from Shelf: 11.87 inches (301 mm) / 12.87 INCHES (327mm) with Turbo installed

For installations where the FX may be exposed to water spray, either mount the FX with the base down (shelf mounting) or with the AC wiring compartment at the bottom (wall mounting). This will minimize the entry of water into the AC wiring compartment.

The FX-ACA can be used to add an AC outlet and one or two of OutBack's AC rated OBDC circuit breakers (up to 70 amps max). When these items are added to the FX, it should only be used in an area that is protected from rain.



Side view of FX with FXA kit attached. The Turbo Kit adds 1" (25mm) additional height to achieve a total height of 12.87" (327mm)

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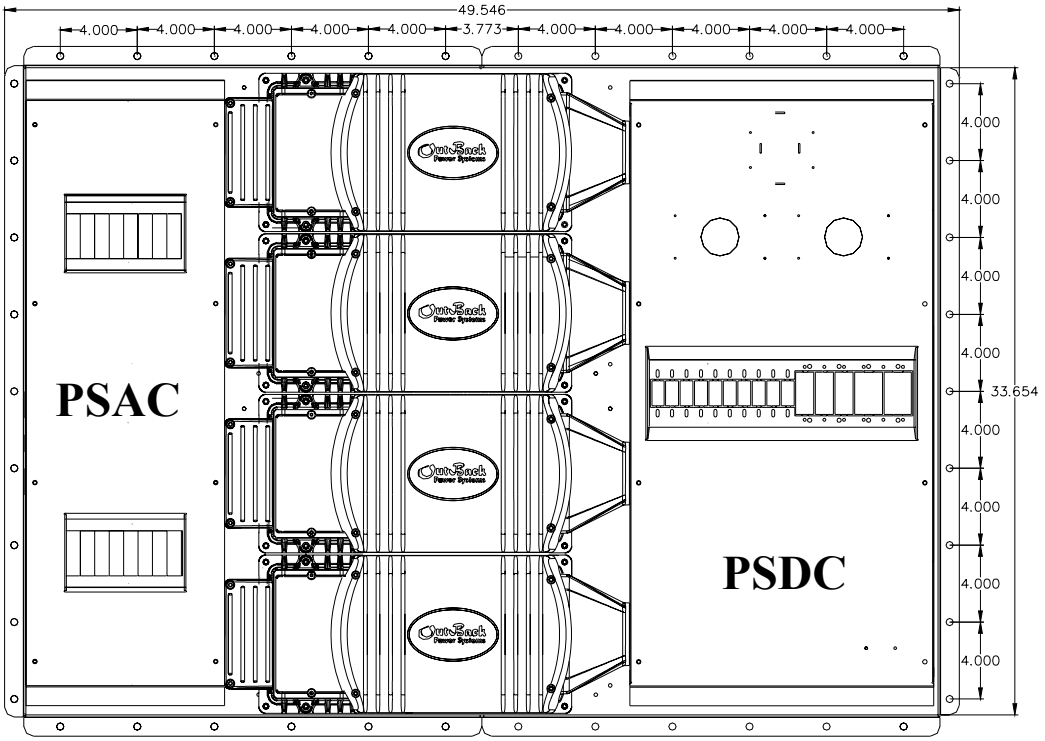
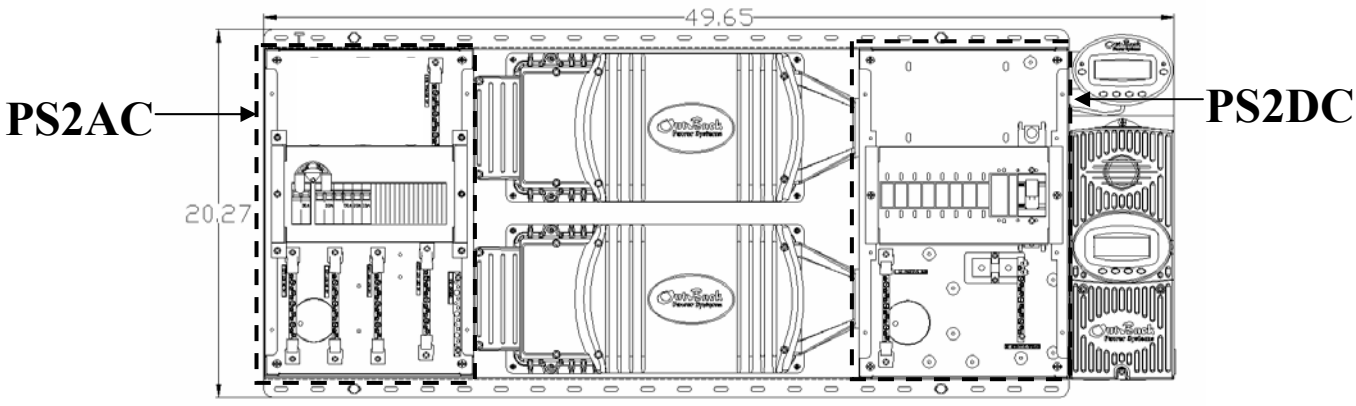
Shown below are complete systems of OutBack FX's for indoor installations. The system with four FX's is shown mounted to the OutBack **PSMP** (**P**ower **S**ystem **M**ounting **P**late). The PSMP comes with six 1x20mm thread forming screws for attaching FX's and breaker boxes. The use of an external toothed star washer (provided) is required on one screw on each piece of equipment in order to bite through the powder coating and ensure grounding of all metal components. The system with two FX's is shown mounted to the smaller OutBack **PS2MP** (the **"2"** in **PS2MP** refers to the maximum number of FX's that will fit) power system mounting plate.

The mounting plate will typically need to be bolted to the studs in a wall using at least four 1/4" or 5/16" (or 7mm) lag bolts 2" (50mm) long. In addition to the mounting plate, these installations are also shown with an OutBack **PSDC** or **PS2DC** (DC breaker box), **PSAC** or **PS2AC** (AC breaker box), **FX-DCA** (**D**C **C**onduit **A**dapter), **FX-DCC** (**D**C **C**ompartment **C**over), and the **FX-ACA** (**A**C **C**ompartment **A**dapter). When two or more FX's are installed in close proximity such as in this installation, it may be useful to install one or more 12VDC fans inside the PSDC that will pressurize the PSDC enclosure – forcing air up through the DC Manifold and down over the external fins. This will improve the battery charging performance by reducing the possibility of the FX's limiting the output due to reaching their maximum allowed temperatures. The AUX outputs of the FX's can be used to control and power the cooling fans.

These additional components are designed to complete the installation to code while offering flexibility for future expansion.





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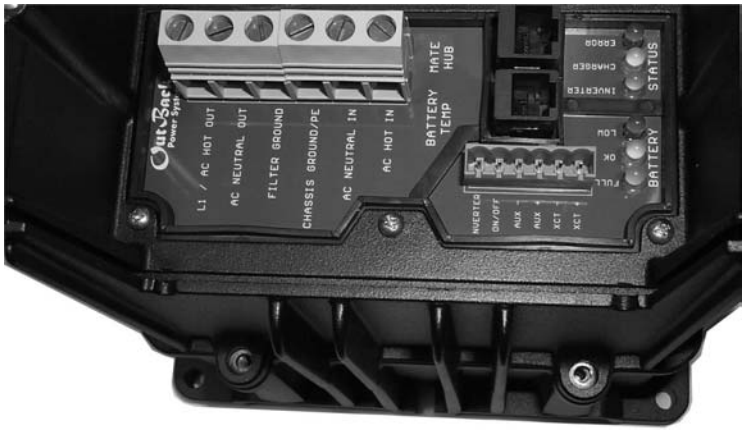
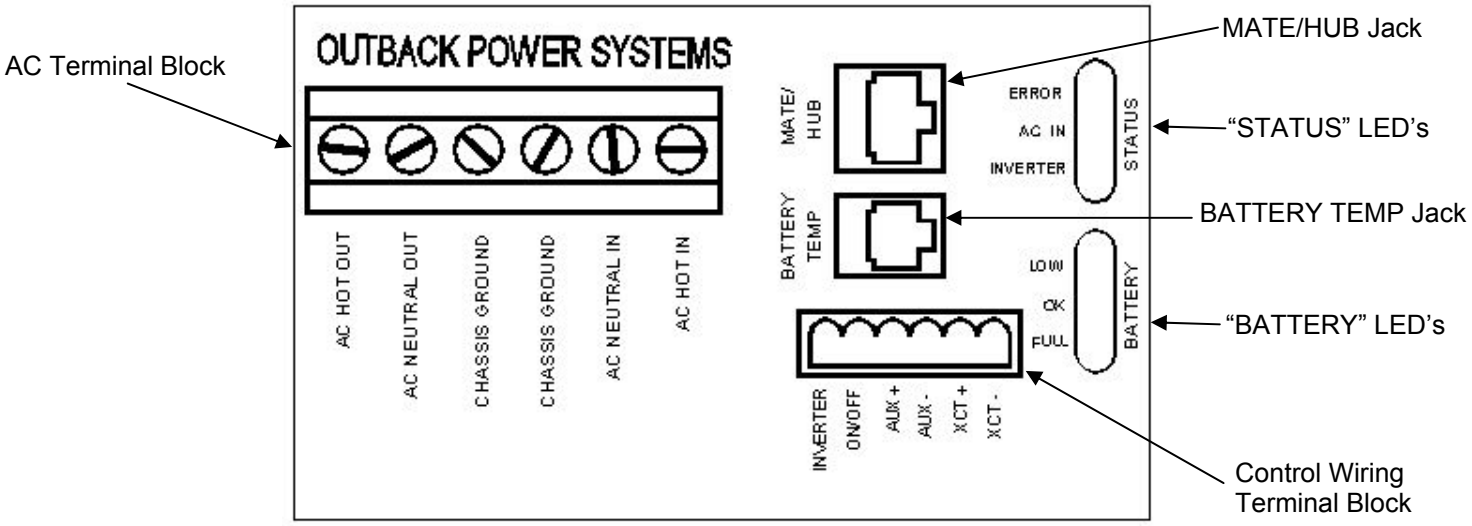
AC WIRING CONNECTIONS

The FX system and the other OutBack balance of system components are designed to make it easy to meet any local and national electrical installation requirements. When used outside of the USA, follow the local installation codes for your country.

If you are not familiar with the local installation codes, you should have the equipment installed by a qualified renewable energy equipment dealer or electrician. All wiring methods are to be made in accordance with the local electric code.



The FX includes an AC wiring compartment with both a removable cover and AC conduit plate. Depending on the type of installation, the AC conduit plate may or may not be used.



The AC terminal block in the AC wiring compartment is designed to accept up to 6 AWG (13.3mm^2) wires. A typical installation will use 8 AWG (8.35mm^2) THHN type wire. 8 AWG (8.35mm^2) is required in order to handle the "Export" model's maximum input current of 30 amps. All AC wiring connected to the AC terminal block must be rated for at least 75˚ C. Torque all of the set screws on the AC terminal block to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).

The AC input should be supplied to the FX through a 30 amp maximum AC branch rated circuit breaker. The AC hot input conductor should be connected to the **AC HOT IN** terminal. The AC neutral input conductor may be connected to the **AC NEUTRAL IN** terminal or a common Neutral bus. The **AC NEUTRAL OUT** terminal is common with the **AC NEUTRAL IN** terminal within the FX and only one AC neutral connection is required to be connected to the FX if a separate AC neutral bus is installed.

The other three terminals of the AC terminal block are for AC output wiring. The **AC HOT OUT** terminal is to be connected to the AC loads through 30A branch rated AC circuit breakers.

Many installations will use the OutBack **AC-IOB-30** input/output bypass breaker assembly mounted in the OutBack PSAC or PS2AC. This bypass assembly allows the user to completely bypass the FX. While in the bypass mode, AC current flows directly from the AC source (generator or grid) through the bypass breaker and out to the loads. In addition to the AC bypass switch, Outback has separate AC input breakers. These also need to be turned off. After the FX has been powered down through the DC breaker, the FX can then be removed for servicing or replacement without loss of AC power to the AC loads of the system.

The AC terminal block includes two terminals labeled **CHASSIS GROUND** (older FX's have one of these terminals labeled "Filter Ground" even though it was never actually filtered). These terminals are connected to each other within the FX. Therefore, it is necessary to connect only one of these terminals to ground. It should be noted that the grounding lug near the battery terminals may also be connected to ground.

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The AC wiring compartment also encloses the green terminal block used for the low voltage control wiring. This six position terminal block can be unplugged to make wiring easier and to simplify the removal and reinstallation of an inverter. Two sets of multi-colored LED indicators are provided to display the operation of the system. One set of three LED's is provided to indicate the voltage level of the battery connected to the DC terminals of the FX. This can be useful in troubleshooting the FX. These battery status LED's operate at the following voltage levels:

	Nominal Battery Voltage		
LED Color	**12 VDC**	**24 VDC**	**48 VDC**
Green	12.5 or higher	25.0 or higher	50.0 or higher
Yellow	11.5 to 12.5	23.0 to 25.0	46.0 to 50.0
Red	11.5 or lower	23.0 or lower	46.0 or lower

There is another set of three LED's which indicates the operation of the FX. These LED's are active as follows:

LED Color	**LED Action**	**LED Indicates**
Green	Solid GREEN	Inverter ON
	Flashing GREEN	Search Mode or Slave Power Save
	Off	Inverter OFF
Yellow	Solid YELLOW	AC Source is Connected
	Flashing YELLOW	AC Input Live – Waiting to Connect to the FX
	Off	No AC Input Present
Red	Solid RED	Error – An Error Message will be automatically displayed on the MATE
	Flashing RED	Warning – A non-critical fault happened to the FX. The MATE can access this info.

INVERTER ON/OFF

The left two terminals of the green terminal block marked **INVERTER** and **ON/OFF** can be used to control the inverter. Connecting the two terminals together through a switch will allow control of the inverter output if a MATE is not available. A small jumper wire is pre-installed into these two positions of the terminal block and needs to be removed in order to add the external switch. If the FX's AC output is off, check that the jumper wire is present and well connected. An installed switch overrides the control provided by the OutBack MATE – if the switch is set to OFF, the MATE will not be able to turn ON the inverter. Cycling this switch quickly from ON to OFF and then to ON again puts the inverter into **Search** mode. Cycling the switch in this fashion again returns the inverter to the ON mode.

AUXILIARY OUTPUT (AUX + / AUX -)

The Auxiliary output system uses the **AUX +** and **AUX –** terminals and is able to be programmed through the MATE to do a variety of tasks. The default use for these terminals is to drive one 12-volt fan for external cooling. The power available at these terminals is 12 VDC at 0.7 amps (8.4 watts) maximum. These terminals should not be connected to any type of DC load which has a high inrush current requirement. The FX includes internal electronic overcurrent protection for this 12 VDC output circuit which auto resets if it is short circuited. No additional fuses are required. Use the OutBack FX Turbo Kit or DC12-FAN for cooling. For automatic or advanced generator start functions, the Auxiliary Output can drive a 12V automotive relay for the 2-wire starting circuitry of a generator. OutBack Power Systems does not support 3-wire start generators; however, a 3-wire to 2-wire conversion kit is available from a different source.

XCT + / XCT -

These terminals are not operational at this time.

BATTERY TEMP {REMOTE TEMPERATURE SENSOR (RTS)}

The OutBack GFX has a 4 position "phone" RJ-11 modular jack located in the AC compartment for the connection of an optional external battery temperature sensor, the **RTS** (sold separately), that allows for automatic adjustment of the battery charging process based on the temperature of the battery. Battery manufacturers provide recommended charge voltages based on temperatures of 25C / 77F. With the RTS attached, the FX adjusts the battery voltage 0.03 volts per degree Celsius for a 12-volt battery bank, 0.06 volts per degree Celsius for a 24-volt battery bank or 0.12 volts per degree Celsius for a 48-volt battery bank. When a **HUB** is used, the RTS must be plugged into the Master FX which must be plugged into port 1 of the HUB. If this is the case, only one RTS is required for all devices plugged into the HUB. The RTS should be stuck to the side of a battery below the electrolyte level so it can measure the temperature of the batteries. The wire from the RTS can be folded and routed underneath the transparent gray plastic lexan cover of the AC wiring compartment to allow connection to the battery. There is a small indentation in the aluminum casting to allow for the wire to pass without affecting the sealing of the covers. When running additional wires under the smoked lexan cover, it may be required to snip some lexan away to allow for wire routing. The lexan will not crack when cutting or filing.

MATE / HUB

The 8 position "Ethernet" RJ-45 modular jack allows direct connection of a **MATE** system controller and display to the FX using standard CAT5 type cabling. If multiple FX's or an FX and an MX-60 charge controller are both in the system, an OutBack **HUB** communication manager is be required for stacking of the FX's and for efficient system performance. . The **HUB** acts similar to a computer hub to combine the communication signals of the devices together into a networked system. OutBack offers two different **HUB** products at this time. The **HUB-4** accepts up to four OutBack products and one **MATE**. The **HUB-10** connects up to ten OutBack products and one **MATE**. **NOTE:** Although the **HUB** has 2 ports for **MATE's** only the 1st port is operational.

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DC BATTERY TERMINALS

The DC terminals are made from solid brass with a stainless steel threaded stud. The threads are M8 x 1.25". The black terminal is negative and the red terminal is positive. **DO NOT PUT ANY WASHERS BETWEEN THE TERMINAL MOUNTING SURFACE AND THE ACTUAL BATTERY CABLE LUG**. Place the flat washer, lock washer and nut on top of the battery terminal lug. **TORQUE TO 60 INCH-POUNDS (5 FOOT-POUNDS OR 6.8 NM) MAXIMUM.**

UL listed DC rated circuit breakers are available from OutBack Power Systems with amperages of 100, 175 and 250 amps DC. All of the OutBack DC breakers come with threaded studs out the back for connection to ring type terminal lugs. **ALWAYS INSTALL BREAKERS OR FUSES WITHIN THE POSITIVE BATTERY CABLE.**

OutBack also offers stud mounted fuses (SMF) for non-NEC code installations in 100, 175, and 250 amp sizes.

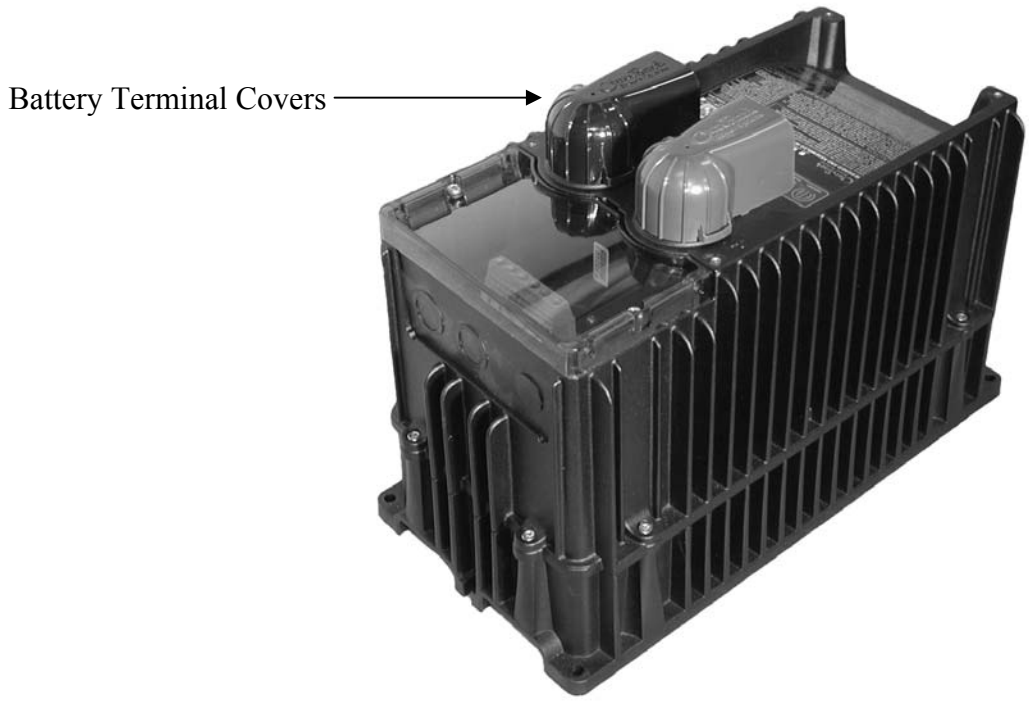
The minimum recommended cable size varies with the DC voltage. FX2012ET installations must use 4/0 AWG (107mm^2) cable minimum. VFX3024E, VFX3048E, and FX2024ET installations can use 2/0 AWG (68mm^2) cable as long as the distances are short (less than 10 feet / 3 meters per cable). FX2348ET installations can use #2 AWG (34mm^2) cable as long as the distances are short (less than 10 feet / 3 meters per cable). If longer distances are required, increase the cable size to the next size as a minimum. Keep the cables together as much as possible for their entire length. Tying or taping the cables together is advisable.

EQUIPMENT GROUND TERMINALS

A set-screw type box lug is provided near the DC terminals to allow the connection of an equipment grounding conductor for the metallic chassis of the FX. It is located behind the battery negative terminal on the top of the inverter casting. A green ground symbol marks the location. When mounting a GFX to an OutBack mounting plate (PS2MP), use a star washer under a mounting screw to provide a good connection to the mounting plate. Connection to the ground terminal is not required.

BATTERY TERMINAL COVERS

The Battery Terminal Covers simply snap on. They are a little brittle, so use some care. Use a flat bladed screw driver blade in the slots provided on the sides of the battery terminal cover to pry the cap off. If the installation is exposed, DC conduit may be required. Connection of 2-inch conduit is possible when the **FX-DCA** and **FX-DCC** options are added to the FX system. **ALWAYS** install the Battery Terminal Covers, even in systems that have an **FX-DCC** included.



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FX-ACA (AC CONDUIT ADAPTER)

This plastic box slips into grooves on the AC end of the FX. This adapter extends the AC wiring compartment to match the PSAC or PS2AC. It also provides more room for wiring than is available when using the supplied flat knockout plate.

There is a 2-inch TSC cut-out on the plastic box to allow it to be used with the PSAC or PS2AC disconnect enclosure.

FX-DCA (DC CONDUIT ADAPTER)

The FX-DCA allows the connection of 2-inch TSC conduit to the FX. It fits on the opposite end of the FX from the AC wiring compartment. The location of the 2-inch conduit opening matches the 2-inch knockouts provided in the PSDC or PS2DC enclosure.

When installing an FX with a PSDC or PS2DC disconnect enclosure, both the FX-DCA and FX-DCC are required.

FX-DCC (DC COMPARTMENT COVER)

The FX-DCC covers the DC terminal area and allows a space which can be used to mount other components such as a DC current shunt. The FX-DCC can be used with or without the FX-DCA.

When installing an FX with a PSDC or PS2DC disconnect enclosure, both the FX-DCA and FX-DCC are required.

FXA ACCESSORY KIT

The FXA includes all three of these FX accessories in one box.

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The HUB communication manager allows the MATE to control and monitor a maximum of ten OutBack products. Currently the HUB comes in two types. The **HUB-4** can connect up to four Outback FX's, MX-60 MPPT charge controllers or a combination of the two. The **HUB-10** (shown below) can connect up to ten Outback FX's, MX-60 MPPT charge controllers or a combination of the two. The FX's can be operated in a stacked or independent configuration. If the FX's are to be stacked, the HUB must be part of the system. In a stacked configuration, the Master FX must be plugged into port #1 of the HUB. The Slave inverters must use the following ports (example: for 8 inverters and 2 MX-60's, the Master must be plugged into Port 1, and the seven Slaves must be plugged into Ports 2-8. The MX-60's can use Ports 9&10). OutBack MX60 MPPT charge controllers can use any of the remaining ports provided no FX's are used. Future OutBack products will also be compatible with the HUB. When using the HUB, the MATE must be plugged into the **1st MATE** port of the HUB. The MATE must be the last device plugged into the HUB for proper operation. .

The HUB manages both the inter-FX communications and the MATE-FX communication.

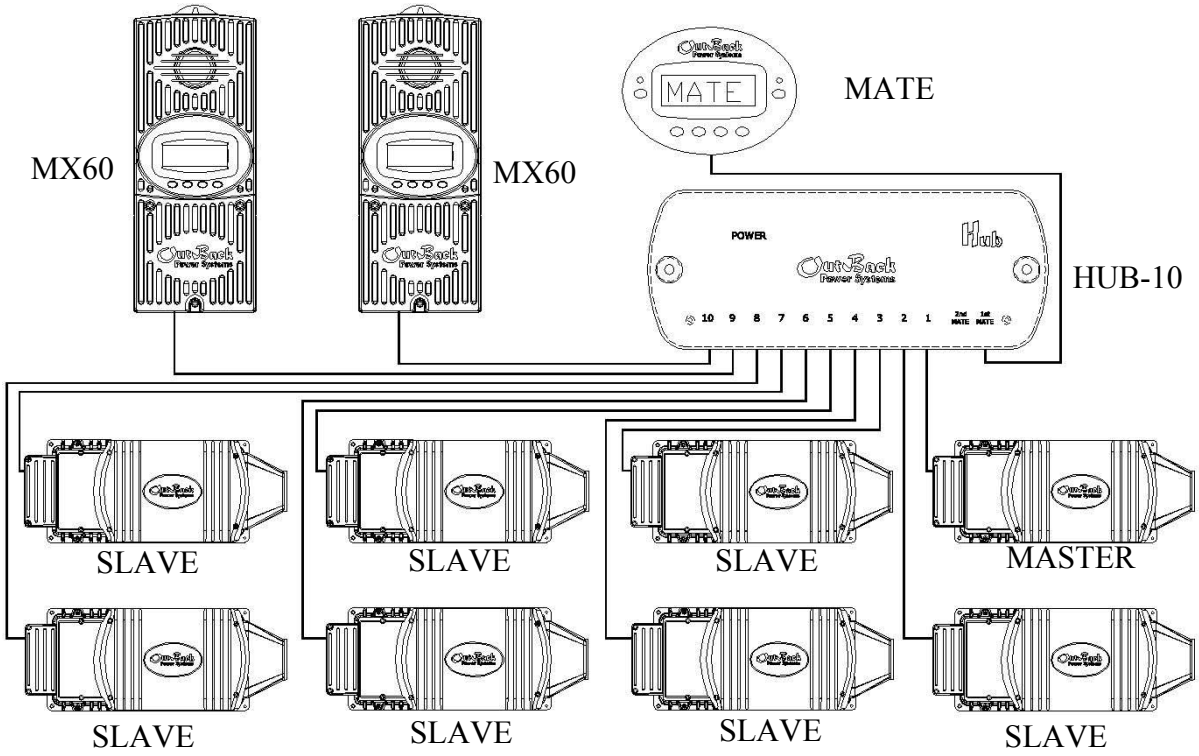
When a HUB is used, the RTS (Remote Temperature Sensor) must be plugged into the Master FX which must be plugged into port 1 of the HUB**.** If this is the case, only one RTS is required for all devices plugged into the HUB**.**

When two or more FX's are stacked in a parallel configuration, the system automatically turns off any excess slave FX's to save power and maximize conversion efficiency. This power save system is fully automatic and works with or without the MATE connected to the system.

On 3-phase systems, there is a limit of one FX per phase (totaling three FX's). In the future, the HUB will be capable of multiple FX's per leg of a 3-phase system. To convert the HUB into 3-phase mode, please read the HUB instruction manual.

One MATE system controller and display can be connected to the HUB. Although there are two Mate ports on the HUB, only the **1st Mate** port is currently operational. The MATE can be located up to 1000 feet (300 meters) from the HUB / system location. Cabling from the HUB to the MATE is completed using standard CAT5 type ethernet communication cable with RJ45 modular 8 conductor jacks. This wiring is considered to be low voltage / limited energy circuitry.

All cabling from the FX and MX60 communication ports to the HUB is made with CAT5 type ethernet communication cabling. The maximum distance from the HUB-4 to the FX or MX-60 should be less than 10 feet. OutBack includes two 3-foot (1 meter) and two 6-foot (2 meter) long CAT5 cables standard with the HUB-4. OutBack includes two 3-foot (1 meter) long and four 6-foot (2 meter) long CAT5 cables standard with the HUB-10. Check with your OutBack dealer for additional cables.



There is a limit of ten FX's when operated as a stacked system.
A total of up to ten OutBack products plus one MATE displays can be used with a HUB-10 (shown above).
The HUB-4 will only accept four OutBack products plus one MATE.

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The Turbo Kit is an addition that can be added to any *sealed* FX. It is highly recommended in hot climates or for installations that can use a few hundred watts of extra power. Typically, the Turbo Kit adds 300-500 watts of power to the FX. In hot climates or when the FX is the primary charging device, the chances of the FX overheating are heightened. When the FX gets to its temperature limits, it will back off the charging process to avoid overheating (and a shutdown of the FX). The Turbo Kit solves this problem by directing air over the casting and its fins, thus causing better convection for the FX.

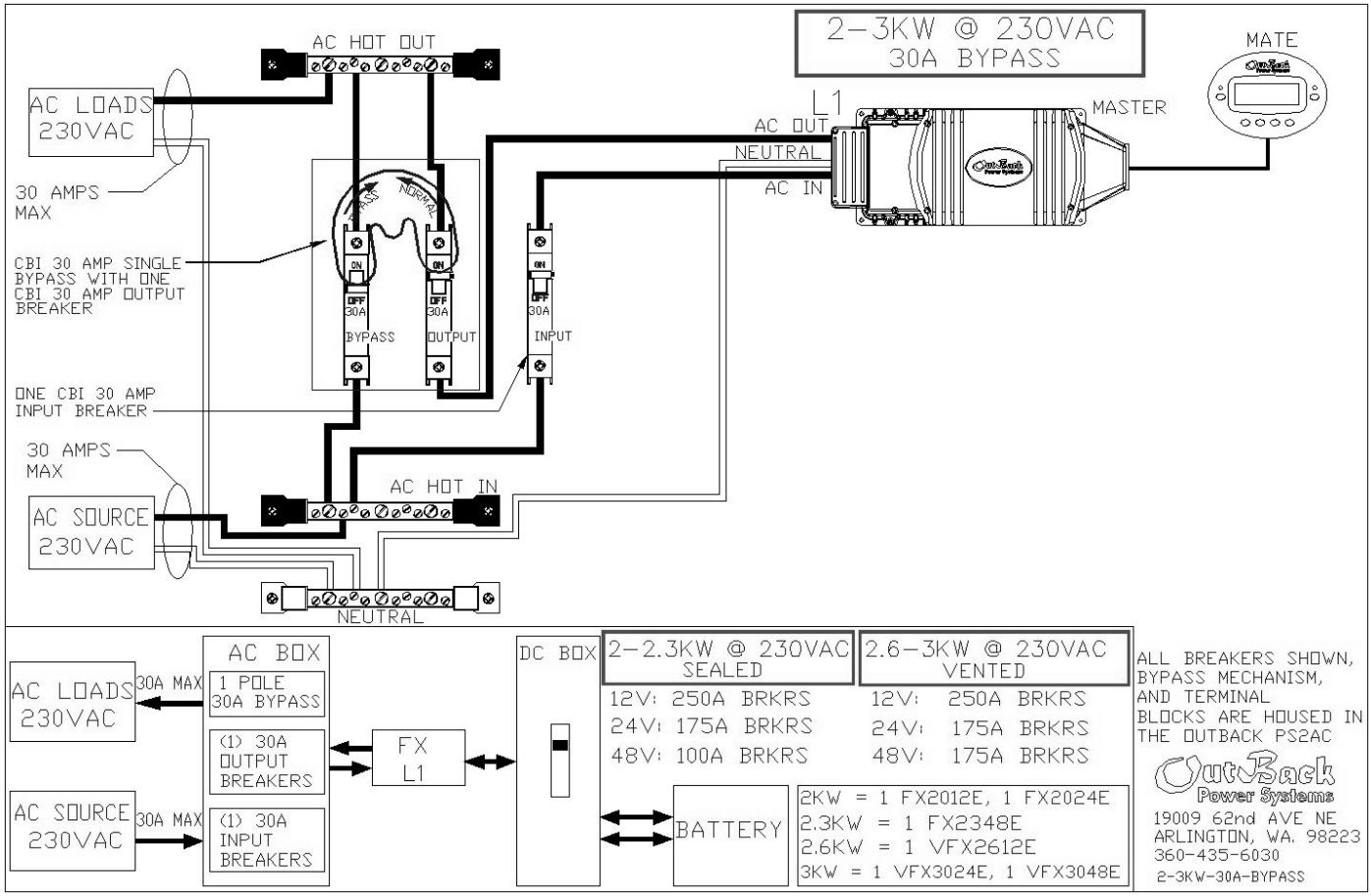
The signal powering the Turbo Kit fan comes from the auxiliary output of the FX. The default setting on the auxiliary output is set to "CoolFan" which starts the Turbo Kit automatically when the FX starts heating up.

The instructions for adding a Turbo Kit are included with the Turbo Kit. If you are also automatically starting a generator using the auxiliary output, you can program the auxiliary output to "GenAlert" and parallel the generator start wires with the Turbo Kit wires. When the generator is running the Turbo Kit is also running. This may seem like a poor solution, but the FX gets hottest when it is charging. If the paralleling of the generator and the Turbo Kit doesn't work properly, adding a 470 uF (micro Farad) electrolytic capacitor (found at your local electronics shop) across the auxiliary output will solve this problem.

The FX System Configuration section shows diagrams of some typical system configurations using the "Export" FX. There are diagrams for a single FX, two FX's in parallel, four FX's in parallel, and a 3-phase system. The diagrams show the proper breakers and wiring for the AC side of the installations as well as connections to the HUB or MATE. Also included is information on the maximum continuous power of the systems and proper DC breaker sizes. This information is dependent on whether the FX's are sealed or vented and on the system's battery voltage.

Single FX System

The following diagram illustrates a typical single FX installation. For this type of installation, use of OutBack Power Systems PS2 system is recommended. The bypass kit for the PS2 system is an AC-IOB-30 using two CBI breakers with a bypass mechanism. Please specify CBI breakers when ordering this bypass kit. The single FX system will require an additional CBI 30 amp breaker for the AC input. Additional breakers can be purchased and installed in the PS2AC if necessary. All AC wiring must handle a capacity of 30 amps AC or more. A single FX system can continuously power 2-3KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A MATE must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



NOTES:

The **AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL** of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system.

The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

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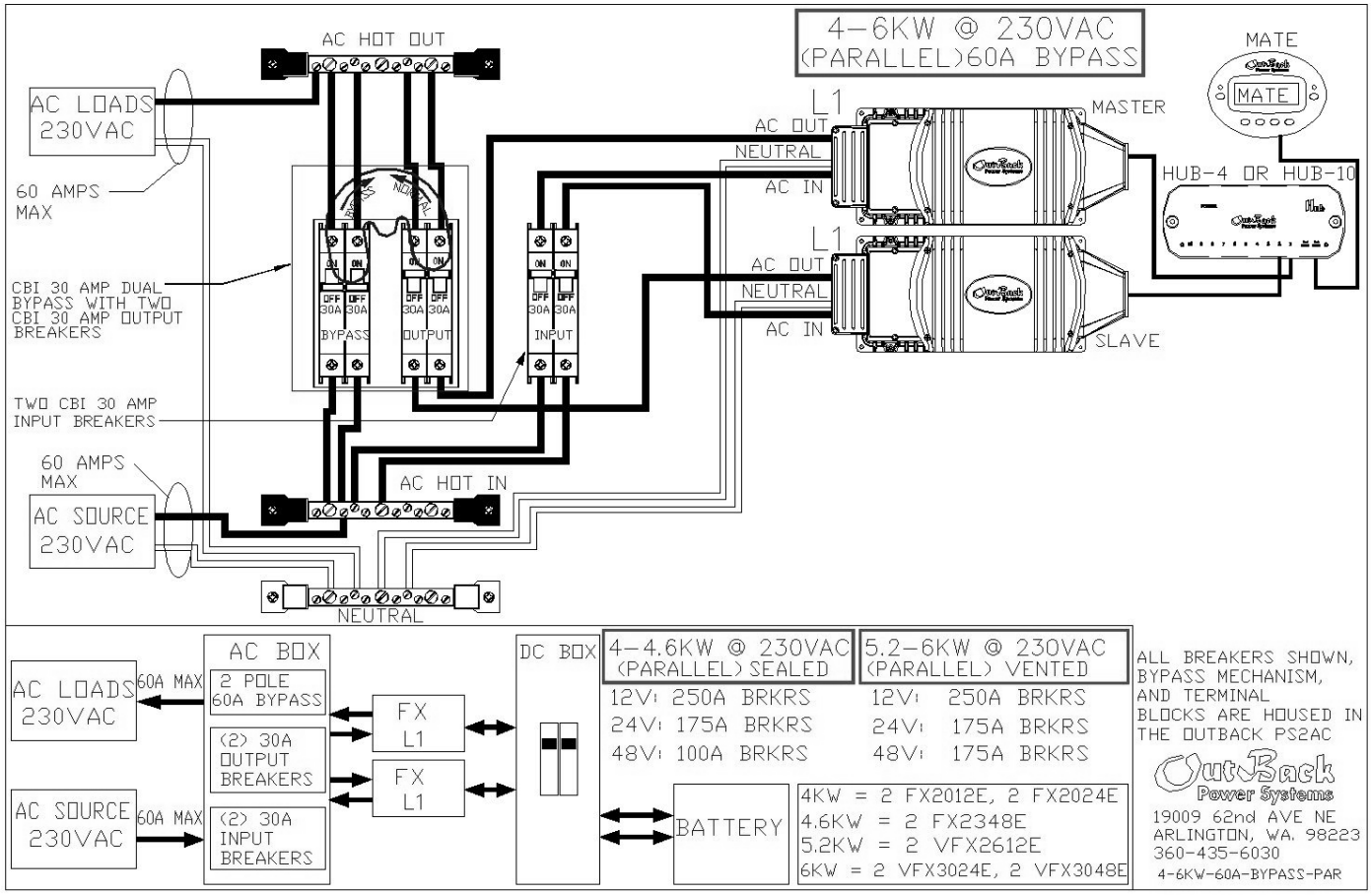
Paralleled Dual FX System

The following diagram illustrates a typical paralleled FX installation using two FX's. For this type of installation, use of OutBack Power Systems PS2 system is recommended. The bypass kit for the PS2 system with two FX's is an AC-IOB-30D using four CBI breakers with a bypass mechanism. Please specify CBI breakers when ordering this bypass kit. The dual FX system will require two additional CBI 30 amp breakers for the AC input. Additional breakers can be purchased and installed in the PS2AC if necessary. The AC wiring from the AC source and to the AC loads must handle 60 amps AC or more. All other AC wiring must handle a capacity of 30 amps AC or more. This type of FX system can continuously power 4-6KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in parallel. A MATE (through the HUB if one is needed) must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.

The diagram below represents parallel stacking of two FX's.



Program the top FX as Master (*1-2PH MASTER*) and the lower FX as an OutBack L1 Slave (*OB SLAVE L1*)

NOTES:

The **AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL** of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system.

The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

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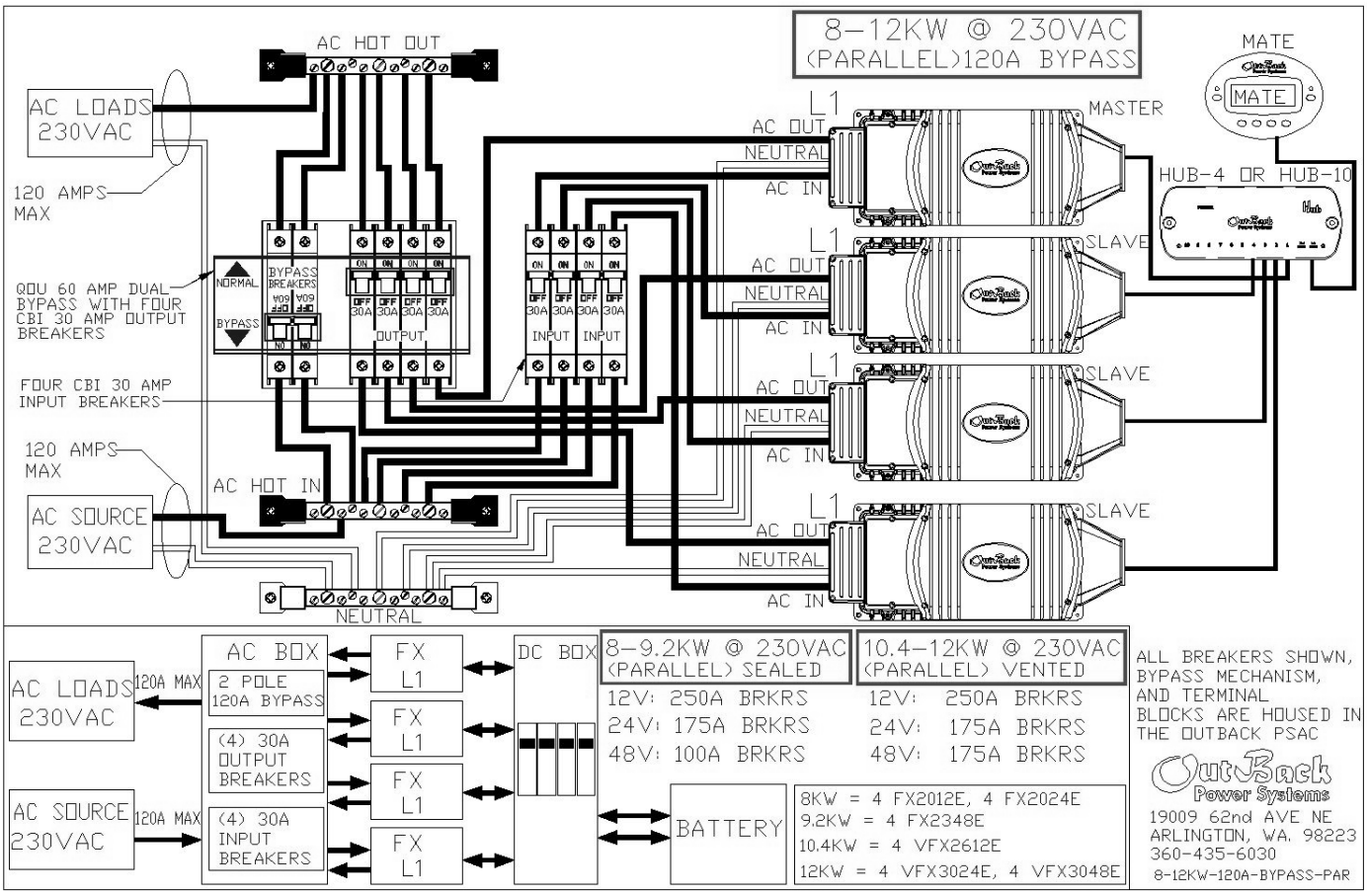
Paralleled Quad FX System

The following diagram illustrates a typical paralleled FX installation using four FX's. For this type of installation, use of OutBack Power Systems PS system is recommended. This FX system will require one AC-IOB-60Q bypass kit. The AC-IOB-60Q bypass kit includes two QOU 60 amp breakers for the bypass and four 30 amp CBI breakers for the AC outputs. The quad FX system will require four additional CBI 30 amp breakers for the AC input. Additional breakers can be purchased and installed in the PSAC if necessary. The AC wiring from the AC source and to the AC loads must handle 120AAC or more. The AC wiring connected to the QUO 60A dual bypass breakers must handle 60 amps AC or more. All other AC wiring must handle a capacity of 30 amps AC or more. This type of FX system can continuously power 8-12KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in parallel. A MATE (through the HUB if one is needed) must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.

The diagram below represents parallel stacking of four FX's.



Program the top FX as Master (*1-2PH MASTER*) and the three lower FX's as OutBack L1 Slaves (*OB SLAVE L1*)

NOTES:

The **AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL** of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system.

The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

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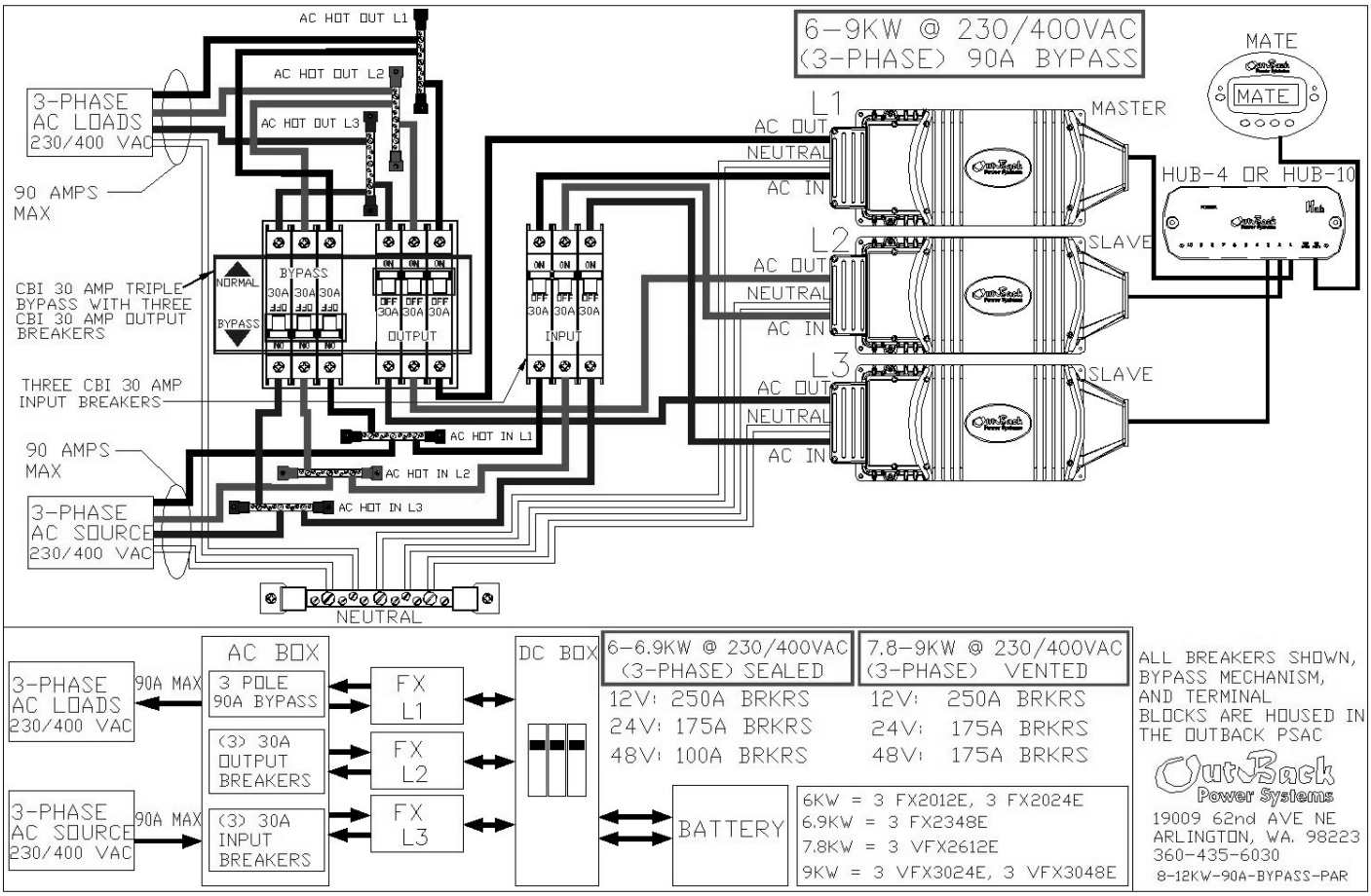
3-Phase FX System

The following diagram illustrates a typical 3-phase FX installation using three FX's. This system will produce 230VAC per phase and 400VAC from phase to phase. At this time there can only be one FX per phase on a 3-phase system. For this type of installation, use of OutBack Power Systems PS-3PH system is recommended. This FX system will require six OBDC-30 CBI breakers for the AC input and AC output and one OBDC-30T CBI breaker for the AC bypass. Additional breakers can be purchased and installed in the PSAC if necessary. The AC wiring from the AC source and to the AC loads must handle 30 amps AC or more. All other AC wiring must handle a capacity of 30 amps AC or more. This type of FX system can continuously power 6-9KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in 3-phase. A MATE (through the HUB if one is needed) must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.

Three OutBack FX's can be stacked in a 3-phase configuration to power loads that require 3-phase power. The diagram below represents 3-phase stacking of three FX's.



Program the top FX as Master (*3PH MASTER*) and the two lower FX's as 3-phase Slaves (*3PH SLAVE*)

NOTES:

The **AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL** of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system.

The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

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Once the FX system installation is completed, it is time to power the system. Leave the breakers on the AC side in the OFF position until the FX's are powered and programmed. Power the FX's by switching the DC disconnect breakers to the ON position. The LED's (Light Emitting Diodes) in the AC compartment of each FX will begin to light. For each FX, one "BATTERY" LED will be lit. This "BATTERY" LED should be either the green "FULL" LED or yellow "OK" LED. If the red "LOW" LED is lit, check the battery voltage and the battery-to-FX cabling for reasons why the FX thinks the batteries are low. The other set of "STATUS" LED's will begin to light. The red "ERROR" LED may blink a few times, but this is just a symptom of powering the FX. About 5 seconds to 10 seconds after power is applied, the green "INVERTER" LED will be lit with the "AC IN" and "ERROR" LED's not lit.

At this point, the FX is producing an AC output voltage. If the user were to connect AC loads to the FX, the FX would use battery power to power the loads. Before doing this, the programming of the FX should be performed using the MATE. If applicable, this programming should include choosing the AC input type of grid or generator (generator is the default, see page 45 for more info), stacking of multiple FX's (see pages 24-26 & 53 for more info), adjusting the charging set points using the battery manufacturers specification (see pages 23 & 48 for more info), setting the time and the date on the MATE (see MATE manual), and programming of the Auxiliary output for the function you wish it to perform (see pages 51 & 52 for more info).

The FX system is now ready to perform per your specification. Switch the AC breakers ON with the bypass mechanism switched to "Normal". Provided that the AC source to the FX's is available, the yellow "AC IN" LED in the AC compartment will begin to blink. If the voltage of the utility grid is within 208 vac to 270 vac and the frequency is within 46 Hz to 54 Hz, the FX will connect to the utility grid. This process takes about 30 seconds and the "AC IN" LED will stop blinking and stay lit.

When the "AC IN" LED is lit, the AC transfer switch within the FX is activated and the utility grid or generator power is applied to the loads. At this time the FX will perform a complete charge on the batteries. This charging process will "Bulk" (raise) the battery voltage until they reach the "Absorb" voltage. The FX will maintain this "Absorb" voltage for the "Absorb Time Period" (default of 1 hour). After the "Absorb" stage, the FX performs a "Float" charge. It lets the battery voltage drop to the "Float" voltage and it then sustains this voltage for the "Float Time Period" (default of 1 hour). Once the hour is up, the FX will go into "Silent" mode, essentially not charging.

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Keeping your battery bank healthy is very important. Although a battery bank may last for over 10 years if properly cared for, it can also be ruined in less than a month if neglected. Since the batteries are the lifeblood of the system and represent a large percentage of the cost to the consumer, keeping them healthy is necessary.

Battery Charging Set Points

In order to make sure the batteries stay healthy, they must never be discharged too much and should be regularly charged back to near-full capacity. (Full capacity is only achieved by equalizing the batteries. Check with the battery manufacturer to see how often your batteries should be equalized.) It is necessary for the system operator to gather some information from the battery manufacturer. This information should include the following…

- The 'Absorb' Voltage
- The 'Float' Voltage
- The 'Equalize' Voltage
- The Recommended Depth of Discharge (DOD) of the batteries

These 'Absorb', 'Float', and 'Equalize' voltage set points should be programmed into the FX through the MATE (see page 48).

Programming the 'Absorb Time Limit' is tougher and requires some experimenting and calculations. We will be assuming that the generator or the utility grid will be the only device charging the batteries. A general rule for knowing when the batteries are fully charged and the absorption cycle can be stopped is the formula C/40. C is your battery bank capacity which you divide by 40. So, take the total amp-hour capacity of the batteries and divide it by 40. The resulting number is the 'DC current' at which the batteries are fully charged. Write this number down. Next, divide the 'DC Current' by the number of FX's that will be charging the batteries. This is your new 'DC Current'. Next, do a calculation to find the 'AC Current' needed to produce this 'DC Current' by following this formula…

$$\text{AC Current} = \frac{(\text{DC Current}) \times (\text{Absorb Voltage})}{(\text{AC Input Voltage})}$$ (Round this number down to the nearest integer)

Next, through the MATE, follow the path MAIN / ADV / (any button) / PASSWORD (141) / FX / CHGR / DOWN / DOWN. The screen should show "Absorb Time Limit'. Set this value arbitrarily high, say 4 hours.

To set the correct time in the 'Absorb Time Limit' the user must perform the following experiment on the system. First, the user should discharge the batteries to the recommended depth of discharge and then connect the AC input to all FX's charging the batteries and let the FX's charge the batteries. The user must carefully watch for when the FX's reaches the 'Absorb Setpoint' voltage and record the current time. Next, the user should watch the 'Charger Current' screen found by following the path MAIN / STATUS / FX / METER and pressing DOWN four times. When the value on the screen matches the 'AC Current' value that was calculated, then again record the current time. The appropriate 'Absorb Time Limit' for the system is the difference between these two times (round this value up if necessary). Follow the path MAIN / ADV / (any button) / PASSWORD (141) / FX / CHGR / DOWN / DOWN to get to the 'Absorb Time Limit' screen and use the INC or DEC buttons to adjust the value. If there is another source (solar, wind, hydro, etc.) charging the batteries, then the 'Absorb Time Limit' can be reduced. It is up to the user to decide or the System Design Specialist to set the 'Absorb Time Limit' if this is the case.

Battery Charging Operation

The FX's battery charger includes five stages. The first stage, BULK, raises the battery voltage to the 'Absorb Setpoint'. The second stage, ABSORB, sustains the battery voltage at the 'Absorb Setpoint' for the 'Absorb Time Limit'. The charger then goes into the third stage, SILENT mode (no charging), until the battery voltage drops to the 'Float Setpoint'. This fourth stage, FLOAT, sustains this battery voltage for the 'Float Time Period'. The charger then goes into 'Silent' mode again until the battery voltage drops to the 'Refloat Setpoint'. This fifth stage, REFLOAT, will start another FLOAT charge. There are additional screens for "Equalize Setpoint' and 'Equalize Time Period'. An equalize charge must be manually started and should be performed once every three months. The time limits that it spends in the various stages are adjustable to provide control and maximize the performance of the battery charger and battery system.

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OutBack & 3-phase Stacking Methods

OutBack Power Systems offers two different ways to stack multiple FX's (up to 10 for single phase systems, but only 3 for three-phase systems). The first thing to consider is if you want all of the FX's in **parallel** (FX's on same AC Output Leg producing 230VAC only) or in **3-phase** (maximum of three FX's, one on each AC Output Leg, producing 230VAC on each Leg and 400VAC between each set of Legs). A HUB-4 or HUB-10 must be included to stack FX's. Below is an explanation of each type of system.

The next two pages explain the Stacking menu and how to program the various types of stacked systems.

PARALLEL (OUTBACK): This stacking method pertains to a system that has two to ten FX's all connected to the same 230VAC Output Leg. The system can be programmed such that only one FX (the Master) stays "On" and the rest of the FX's (the Slaves) are asleep. The Slaves come on only when the power requirement is high enough that the Master FX calls on the Slave FX's to help with the load. It is also possible to program the system to keep any number of FX's "On" while the remaining FX's are asleep. The AC Input source (usually a generator or utility grid) must be 230VAC.

3-PHASE: This stacking method pertains to a system that has three FX's connected to three 230VAC Output Legs that will produce 400VAC between any two Legs of the 3-phase system. In this stacking method only three FX's can be used. Each of the three FX's will be connected to its own 230VAC Output Leg. To set the system up properly an adjustment to the HUB is necessary. Within the HUB is a jumper that needs to be changed in order for the system to operate correctly. See the HUB manual for instructions on this procedure. The AC Input source (generator or grid) must be a 230VAC/400VAC 3-phase source connected to the AC Input terminals of the three FX's.

Stacking Procedure

This section will help inform you on how to set up stacking correctly and what the screens in the stacking menu mean. (Remember, for 3-phase stacking a jumper must be set to the 3-ph position in the HUB. See HUB manual for further information.) Make sure that the FX's connect to the lowest numbered ports of the HUB. First, turn off all AC breakers (the Bypass breaker can be left on). Next, turn on all FX's using their DC breakers and verify that the MATE recognizes all FX's. You can verify this by watching the MATE go through its boot-up sequence. The MATE's boot-up sequence will show the following screens: (1) "G'day Mate!" (2) "OutBack Power Systems" (3) Version (4) "HUB Found" (5) Hub ports and the OutBack devices connected to them. Screen (5) will allow you to verify that the MATE sees all of the FX's. If it doesn't see all of the FX's or if you aren't sure, you can do one of two things. Either disconnect and reconnect the MATE to the HUB or do a re-poll with the MATE. A re-poll on the MATE can be done by following the path **MAIN / SETUP / MATE / PG2 / COMM / REPOLL** (see the MATE manual for proper operation of the MATE). Once you are sure that the MATE recognizes all the FX's connected to the HUB, you must access the "STACK" menu. This can be found on the MATE by following the path **MAIN / ADV / any button (this screen serves as a warning only) / PASSWORD (press the INC and DEC buttons until the number is 141 and then press ENTER) / FX / PG2 / PG3 / STACK**. You are now in the menu used for stacking FX's. Before continuing we will inform you on what each screen pertains to, the possible selections of that screen and how to choose the next FX for proper programming.

STACK PHASE

The "Stack Phase" screen establishes which FX is the master and which FX's follows the master's commands. Each FX has a default of "1-2ph Master" (one or two phase Master). The FX on port 1 of the HUB is always a Master (and usually the only Master), otherwise the MATE will give a communication error. For a single phase system, the FX in port 1 of the HUB should remain a "1-2ph Master". For a 3-phase system, the FX on port 1 of the HUB must be changed to a "3ph Master" (this procedure will be explained soon). To select the next FX connected to the HUB, press the PORT button on the MATE. In the upper right-hand corner of the MATE's screen is the "port" indicator. It will display a "P" followed by a number indicating the port it is controlling (for example "P01" indicates port 1, the Master FX's port). Repeatedly pressing PORT on the MATE will cycle through the ports on the HUB that have FX's connected to them. Stop when you have reached a port that has an FX on it that needs to be a Slave. By pressing the INC (increase) and DEC (decrease) buttons on the MATE, you can select the proper type of Slave that is appropriate for your system. Below are the different selections in the STACK PHASE menu with a description of what they do.

1-2 PH MASTER: 1-2 PH MASTER is used for stand-alone (one) FX systems OR as the MASTER of a single phase or split phase system. Set the stack phase of the FX you want as the master to '1-2 PH Master' (if it isn't already) and make sure it is in port 1 of the HUB. It is acceptable to have every FX connected to the HUB be a "1-2ph Master". If this is the case, each FX must be connected to a separate AC Output Leg (both Hot and Neutral). The master FX is always considered to be the L1 phase.

CLASSIC SLAVE: (NOT TO BE USED ON "EXPORT" SYSTEMS) If you have a system with two FX's that you wish to put in series, set the stack phase of the FX you want as the slave to "Classic Slave" and make sure it is in port 2 of the hub. "Classic" stacking is meant for 120/240VAC systems (where applicable) where each FX handles their own 120 volt phase. The combination of the two FX's creates 240 volts to run 240VAC loads. If this FX is set to 'Classic Slave' then its output is 180 degrees out of phase from the master and is considered to be the L2 phase. Classic stacking can only stack two FX's and there is no load sharing which is possible with 'OutBack' stacking.

OB SLAVE L1: Single Phase: If you have a system with two to ten FX's and you wish to produce 230VAC on the same AC Output Leg, set the stack phase of the FX's you want as the slaves to "OB Slave L1" and make sure that they are in the lowest numbered ports of the HUB. "OB Slave L1" is used for FX's that run in parallel with the master. These FX's are considered the L1 phase.

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Stacking Procedure (Continued)

OB SLAVE L1: Split Phase: (NOT TO BE USED ON "EXPORT" SYSTEMS) Alternately, if you have a system with two to ten FX's and an X-240 autotransformer and you wish to produce 120VAC on both AC Output Legs and also 240VAC between the two AC Output Legs (where applicable) then set the stack phase of the FX's you want as **parallel** slaves (Leg 1) to "OB Slave L1". Make sure the slave FX's are in the lowest numbered ports of the HUB. "OB Slave L1" is used for FX's that run in parallel with the master. OutBack's X-240 autotransfromer must be included in the system to use this stacking option. This FX is considered the L1 phase.

OB SLAVE L2: (NOT TO BE USED ON "EXPORT" SYSTEMS) If you have a system with two to ten FX's and an X-240 autotransformer and you wish to produce 120VAC on both AC Output Legs and also 240VAC between the two AC Output Legs (where applicable) then set the stack phase of the FX's you want as **series** slaves (Leg 2) to "OB Slave L2". Make sure the slave FX's are in the lowest numbered ports of the HUB. "OB Slave L2" is used for FX's that run in series with the master. OutBack's X-240 autotransfromer must be included in the system to use this stacking option. This FX is considered L2 phase.

3PH MASTER: If you have a system with three (and only three) FX's and you wish to produce 230VAC on three AC Output Legs as well as 400VAC between each AC Output Leg, set the stack phase of the FX you want as the master to "3PH Master" and make sure it is in port 1 of the HUB. The 3-phase stacking is similar to "Classic" stacking in the sense that each FX acts independently and cannot help out other phases. The HUB also has a jumper on it that needs to be changed for 3-phase stacking (refer to the HUB manual). This FX is considered phase A.

3PH SLAVE: If you have a system with three (and only three) FX's and you wish to produce 230VAC on three AC Output Legs as well as 400VAC between each AC Output Leg, set the stack phase of the 2 FX's you want as the slaves to "3PH Slave" and make sure they are in ports 2 and 3 of the HUB. There are no selections to differentiate between phases B and C. When you set the jumper in the HUB for 3-phase, the HUB tells each slave which phase they are. "3PH slave" on HUB port 2 is considered phase B. "3PH slave" on HUB port 3 is considered phase C.

The next two screens in the "Stack" menu on the MATE are the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" and "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" screen. You can access these screens by pressing DOWN once or twice if you are currently on the STACK PHASE screen. Since nobody (seriously, even here at OutBack) understands these screens the first 3-4 times they are explained, we offer our best effort right here. These screens only make complete sense after you've read and understand both of them. These two screens only pertain to systems that have "OB Slave L1" type slaves.

POWER SAVE LEVEL MASTER ADJUST ONLY

Only adjust the value on this screen if you wish to have one or more of the Slave FX's AC outputs "On" at all times. This may be necessary if you are having trouble starting large loads. The first thing to note is that this screen pertains to the Master FX only and therefore you must be on port 1 (P01 in the upper right-hand corner of the MATE). Press PORT on the MATE until you see P01 on the MATE. The number to the right of the screen is the "Slave Rank Designator". The default value for the Slave Rank Designator is zero (0) on every FX. By pressing INC on the MATE you can increment (by whole numbers) this value. If this value is set to a number greater than zero then the Master FX will keep the Slave FX's AC outputs "On" if they have a "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" value equal to or less than this number (for instance, if this value is set to "2" then all the Slaves with "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" values of "1" or "2" will have their AC outputs kept "On"). Any Slave with a "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" value greater than the Masters "POWER SAVE LEVEL **MASTER** ADJUST ONLY" value will be "asleep" (AC output is "Off") until the Master calls upon it to help with large loads.

POWER SAVE LEVEL SLAVE ADJUST ONLY

This screen allows you to assign the "Slave Rank" of the Slave FX's in the system. The first thing to note is that this screen pertains to the Slave FX's only and therefore you must be on port 2 or greater on the MATE (shown in the upper right-hand corner of the MATE as P02 or P03, etc.). Press PORT on the MATE until you see the port that you wish to program displayed on the MATE. The number to the right of the screen is the "Slave Rank". All Slave FX's have "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" (or "Slave Rank") default values of 1. If this value is not changed from 1 then one of two things will happen. First, if the Master FX has been programmed with a value of 1 or greater in the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" screen then all of the Slave FX's will remain "On" at all times. Second, if the Master FX has been programmed with a value of zero in the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" screen then all of the Slave FX's will remain "Off" until the Master FX needs help and calls for the Slave FX's with "Slave Rank" equal to 1 to come "On". This will turn on all of the Slaves. If your system includes more than one Slave FX then you may want to choose a different "Slave Rank" for each Slave FX. This allows them to come "On" one at a time which saves power in the long run. To change the "Slave Rank" of a given Slave FX, press the PORT button on the MATE until the Slave FX's port appears in the upper right-hand corner of the MATE. Next, press INC to increase the value until it is what you desire. Repeat this process for each Slave in the system. When a Slave FX has a "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" value greater than the Master FX's "POWER SAVE LEVEL **MASTER** ADJUST ONLY" it will remain "Asleep" (and save about 18 watts). When large loads are present, the Master FX will call out for "Slave Rank" = 1 to come "On" (unless it is already "On" due to the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" setting being 1 or greater). If the Master FX needs even more power then it will call out for "Slave Rank" = 2 to come "On" and so on.

Using these three screens will allow you to stack your system in many different configurations. As an addition to the explanations above, we have offered some examples of common systems outlined below.

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System Examples

STACKED SYSTEM USING OUTBACK'S "PARALLEL" STACKING

This type of system may have between 2 and 10 FX's that will have their AC Outputs connected to the same Leg. We will be using a Quad-Stacked (4 FX) system as an example. If you have less than four FX's then any reference to FX's on ports greater than the amount of FX's in your system will not apply to your system. If you have more than four FX's then follow the natural pattern of programming that will become apparent in this example.

In a quad stack, I am assuming that the top FX is plugged into port 1 of the HUB, the 2nd FX down is plugged into port 2, the 3rd FX down is plugged into port 3, and the 4th FX down is plugged into port 4 (This is not a rule, just for simplicity). Using the MATE, go to the stacking menu (explained earlier in the "Stacking Instructions" section). You are now at the 1st stacking menu called "Stack Phase". In the upper right hand corner of the mate screen will always be the HUB port number of the FX you're working with at the time. Let's start out with the FX that's on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the "Stack Phase" of the port 1 FX to "1-2 PH Master". Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the "Stack Phase" menu but we are now talking to the FX on port 2. Push the INC button two times to set the "Stack Phase" to "OB Slave L1". Press the PORT button again to talk to the FX on port 3. Push the INC button two times to set the "Stack Phase" to "OB Slave L1". Press the PORT button again to talk to the FX on port 4. Push the INC button two times to set the "Stack Phase" to "OB Slave L1". Now you've set 3 FX's (P02-P04) to be in parallel with the master (P01). If you have more FX's in the system then program them as "OB Slave L1".

Press the DOWN button 2 times to get into the "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" menu. Press the PORT button until P02 is displayed in the upper right corner of the screen. This menu pertains to the slaves only which is why we're starting out with port 2. The setting from the factory should be already set to 1 which is the 1st rank slave. If it's anything other than 1, then press the INC or DEC buttons to make it 1. Press the PORT button to talk to the port 3 FX. Press the INC button to change the "power save level slave adjust only" to 2 which is the 2nd rank slave. Press the PORT button to talk to the port 4 FX. Press the INC button until the setting is 3 for 3rd rank slave. Now you've set the rank for all the slaves. If you have more FX's in the system then press the PORT button to access the next FX and press INC until the number on the screen is 1 number less than the port number (i.e. if you are on P05, the number on the screen should be 4).

Let's back track a little by going to the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" menu. Do this by pressing the DOWN button, TOP button, then DOWN button. Verify that the screen you are on now is the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" screen and change the port to P01. Turn on all of your FX's AC Output breakers. The master FX's "Inverter" LED should be solid and all the slaves "Inverter" LED's should be blinking. Adjust the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" from 0 to 1 and watch the 1st slave's "Inverter" LED go solid. When the "Inverter" LED is on solid, this means that the inverter is on. When the "Inverter" LED on the slave is blinking, this means the FX is asleep. Adjust the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" to 2 and watch the 2nd slave's "Inverter" LED turn on. Adjust the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" to 3 and watch the 3rd slave's "Inverter" LED turn on. If you have more than three slaves then keep increasing the value in the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" screen and verify that each slave's "Inverter" LED comes on as expected. You have now verified that all FX's are stacked correctly so adjust the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" back down to 0 and have fun with your system!

3-PHASE STACKED SYSTEM (3 FX'S ONLY)

This type of system will include only three FX's and must be set up as described here. Turn off all AC Output and AC Input breakers before powering up FX's. In 3-phase stacking, I am assuming that the top FX is plugged into port 1 of the HUB, the 2nd FX down is plugged into port 2 and the 3rd FX down is plugged into port 3 (This is not a rule, just for simplicity). The HUB has a jumper on it that needs to be changed for 3-phase stacking (refer to the HUB manual). Using the MATE, go to the stacking menu (explained earlier in the "Stacking Instructions" section). You are now at the 1st stacking menu called "Stack Phase". In the upper right hand corner of the mate screen will always be the HUB port number of the FX you're working with at the time. Let's start out with the FX that's on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the "Stack Phase" of the port 1 FX to "3ph Master". The Master FX is considered phase A. Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the "Stack Phase" menu but we are now talking to the FX on port 2. Push the INC button five times to set the "Stack Phase" to "3ph Slave". Now you've set this FX (P02) as phase B, producing 208VAC between itself and the master (P01). Press the PORT button again and verify that the label in the upper right hand corner displays P03. We are still in the "Stack Phase" menu but we are now talking to the FX on port 3. Push the INC button five times to set the "Stack Phase" to "3ph Slave". Now you've set this FX (P03) as phase C, producing 208VAC between itself and the master (P01) and also 208VAC between itself and the FX on phase B. The next two screens in the STACK menu do not apply to a 3-phase system, so you need not worry about them. Remember that the AC input to a 3-phase system must be a 3-phase source (generator or grid). Have fun with your system!

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The Aux output of the FX can be programmed to start a 2-wire gas or diesel generator automatically when the batteries need charging. There are two separate ways to accomplish this function; **AGS** (**A**dvanced **G**enerator **S**tart) and **GenAlert.** AGS is a function of the MATE while GenAlert is a function of the FX.

AGS has more features and therefore it can start the generator under many different types of conditions. The AGS features include Quiet Time, Voltage Start, Load Start, Must Run, and Exercise. Since AGS is a function of the MATE see the MATE manual for instructions. **NOTE:** The MATE must have a Code revision of 3.30 or greater (found on the third start-up screen of the MATE).

GenAlert is another way to automatically start the generator. It is programmed through the MATE but it doesn't have all of the features that AGS has. It works on a voltage start system where the generator will start when the battery voltage reaches a certain voltage for a specific period of time and stop when the battery voltage reaches a higher voltage for a different period of time. These voltages and time periods are programmed through the MATE. If you wish to use the GenAlert option, follow the instructions below. **NOTE:** If both AGS and GenAlert are programmed, AGS will be used.

Starting from the main menu, press the **<ADV>** button to get into the advanced menu (the "password" is **141**, press **<INC>** until the number reads 141 and then press **<ENTER>**). From the Advanced menu press the **<PG2>** button then the **<PG3>** button, then the **<AUX>** button to get into the auxiliary menu. The first screen that comes up is the "aux output control" which tells the FX to keep the aux output off, on, or automatically do what the auxiliary output function is. In this case we want to keep the default setting on "AUTO".

Press the **<DOWN>** button to get into the "aux output function" menu. This is the menu where we tell the auxiliary output what function we want it to be. In this case we want it to start a generator. The default setting is "CoolFan" so press the **<DEC>** button 3 times so the display reads "GenAlert". Now that the function is set to start a 2-wire start generator, the start and stop parameters need to be set.

Press the **<DOWN>** button to get into the "genalert on setpoint" menu. This menu adjusts the battery voltage set point to where you want the generator to start at. The default setting is 11, 22, or 44 volts (depending on your FX) which you can adjust. Press the **<INC>** or **<DEC>** buttons to change this setting.

Press the **<DOWN>** button to get into the "genalert on delay" menu. This menu adjusts the time you will allow the battery to be at the "genalert on setpoint" voltage before starting the generator. The default setting is 4 minutes at the "genalert on setpoint" and the generator will start. Press the **<INC>** or **<DEC>** buttons to change this setting.

Press the **<DOWN>** button to get into the "genalert off setpoint" menu. This menu adjusts the battery voltage set point to where you want to stop the generator. The default setting is 14, 28, or 56 volts (depending on your FX) which you can adjust. Press the **<INC>** or **<DEC>** buttons to change this setting.

Press the **<DOWN>** button to get into the "genalert off delay" menu. This menu adjusts the time you will allow the battery to be at the "genalert off setpoint" before stopping the generator. The default setting is 9 minutes at the "genalert off setpoint" and the generator will stop. Press the **<INC>** or **<DEC>** buttons to change this setting.

Even though you have set the off function for the generator, there are two other ways that the auxiliary output can stop the generator. If the charger settings of the FX reach float or silent mode, that overrides the "genalert off setpoint" because the FX figures that the batteries are charged. The generator will turn off based on whatever comes first, genalert off, float, or silent. If you want to stop the generator based on float or silent, either extend the "genalert off delay" beyond what is capable of the charger to achieve or raise the "genalert off setpoint" higher than the "absorb setpoint" (default of 14.4, 28.8, or 57.6 volts depending on your FX).

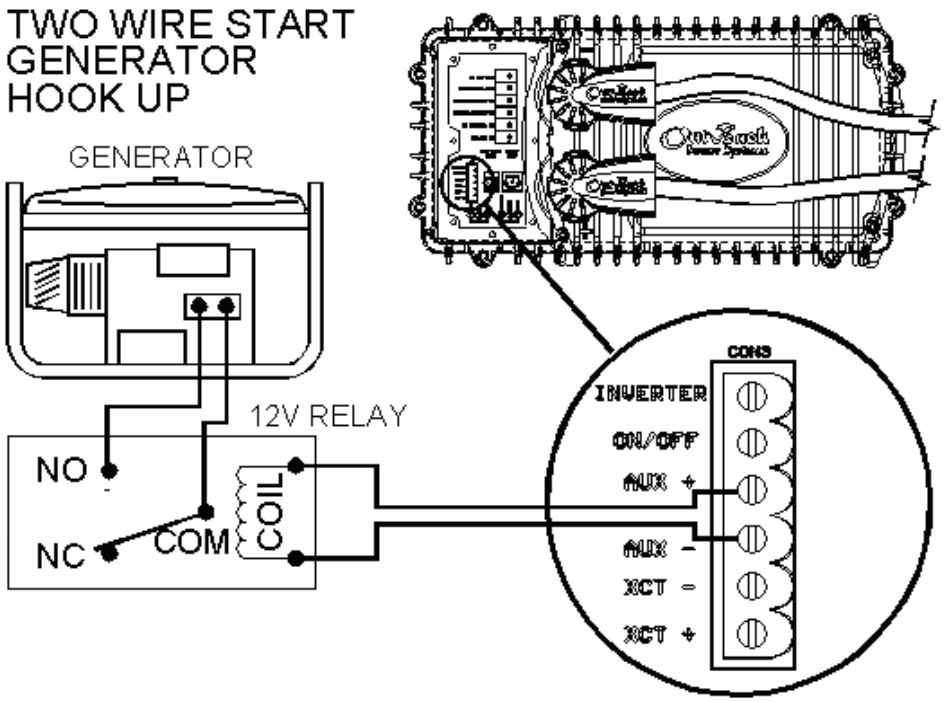
The following schematic shows how to hook up a relay that interfaces with the 2-wire start generator. 3-wire start generators require an adapter like the Atkinson GSCM available at: www.atkinsonelectronics.com.

Here are a couple of relays to use. Most 12V relays will work of generator starting. Select one between 2 and 30 amp contacts.

1) Radio Shack SPST 30 amp Auto Relay #275-226

2) Grainger 10 amp SPDT relay #5ZH14
MFR: Omron #G2R-1-S-DC12

The socket for this relay is….
Grainger #6C898
MFR: Omron #P2RF-05-E



The OutBack MATE system controller and display allows you to program, control, and monitor the operation of one or more FX's as well as the MX60 MPPT charge controller.
When connecting a MATE to more than one product is required, a HUB-4 or HUB-10 communication manager must be included in the system. The MATE can be located up to 1000 feet (305 meters) from the FX system using standard 8 conductor CAT5 type communication cabling. This wiring is considered to be a low voltage / limited energy circuit.

The MATE can be used to program the FX and then removed. All of the settings in the FX are stored in non-volatile memory inside of the FX itself - the battery can be removed from the FX and the settings will not be lost.

The MATE also allows for monitoring and control of the FX system's operation. Some of the more advanced system operating modes (such as the *HIGH BATTERY TRANSFER (HBX)* function or the *ADVANCED GENERATOR START (AGS)* function) requires that a MATE be connected to the FX system all of the time.

The operating software used in the MATE is upgradeable to allow for the addition of new features to existing systems. It can be easily removed and exchanged by the system user – there is a single CAT5 RJ45 modular connection.

The MATE also includes an RS-232 PC serial communication port to allow monitoring and remote modem access of the system via phone or internet. This PC software is currently being developed by third party companies and will soon be offered as an option through your OutBack Power Systems dealer. Tracking software is available at www.RightHandEng.com/OutBack.

Outback Power Systems currently offers five different versions of the MATE.

MATE: Basic MATE with an oval encasing (shown below). The casing is white in color. This option includes an RS-232 port.

MATE B: Basic MATE with an oval encasing. The casing is black in color. This option includes an RS-232 port.

MATE 2: Black flush mount version of the MATE shown below. This option includes an RS-232 port.

MATE 2M: Black flush mount version with a simplified menu structure designed specifically for the Mobile market. No RS-232 access.

MATE 2M-232: Same as MATE2M but with the RS-232 port accessible.

OutBack MATE System Controllers

"MATE" "MATE B"

"MATE 2" "MATE 2M" "MATE 2M-232"

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OutBack MATE

System Controller and Display

Each one of the soft keys corresponds to a word on the bottom line of the LCD display

The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade. For your particular menu system, consult your MATE manual.

The following pages show the portion of the menu structure that relates to the FX. Most of the menu will be consistent no matter what type of FX you have purchased. The MATE displays that follow are from the most current MATE being sold by OutBack Power Systems.

The *DC voltage* values (the letters "vdc" usually follow these values) shown in the following MATE displays will be the default values for a 12V version of the "Export" FX. For the 24V version, multiply these values by 2. For the 48V version, multiply these values by 4. This multiplication process includes the incremental values (when changing a voltage setting you will use the 'increment' (INC) or decrement (DEC) buttons). For example, for a 12V FX the increment value is 0.1V. A 24V FX has an incremental value of 0.2V and a 48V FX has an incremental value of 0.4V.

All values displayed in the "Setup" and "Advanced" menus are the default values unless otherwise stated.

For "M" versions of the MATE (example: MATE 2"M"), only the "Status" and "Advanced" menus are the same as non-"M" versions of the MATE. If you are using an "M" version of the MATE, please consult the MATE manual for proper navigation and screen information.

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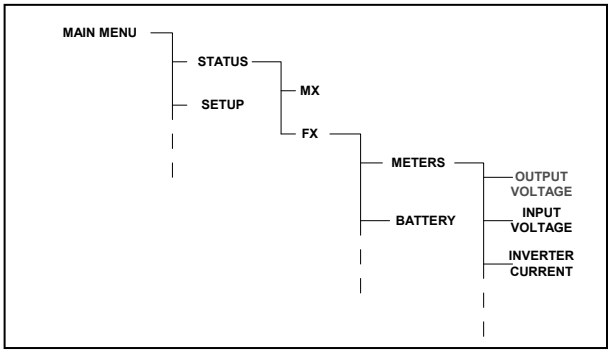
This section of the manual will cover how to use the buttons on the MATE to navigate the menus.

NOTE: The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade.

MENU STRUCTURE

The OutBack MATE uses a branching menu structure to display various OutBack products operation modes and status. The menus are divided by product type and are categorized by type of setting or by information being displayed.

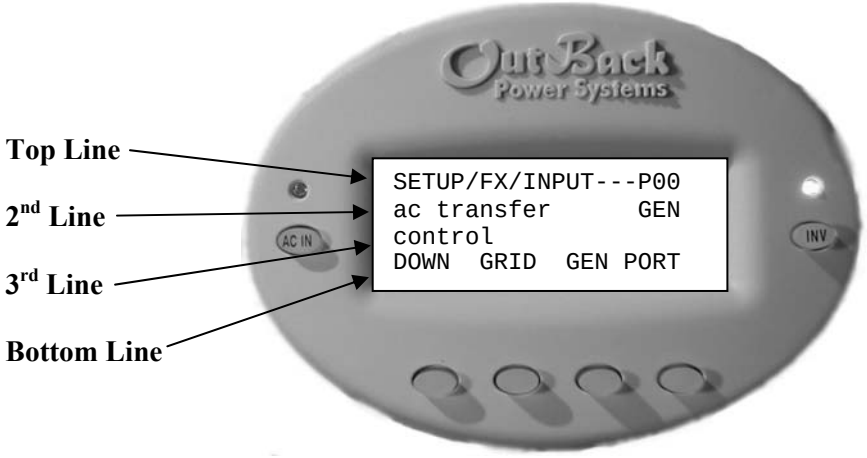
An example of the menu structure is shown to the right. All the screens that show AC meters are grouped together in one menu tree allowing the user to find the required meter with a minimum of button presses.



The top line of the MATE display will show the 'path' to the current menu; in this example it is STATUS/FX/METERS.

```
STATUS/FX/METERS---------
output                230 vac
voltage
DOWN   UP   TOP   PORT
```

MATE BUTTONS



The MATE uses a six button user interface to navigate the menus and to change set points of various OutBack products.

Two buttons are dedicated to the FX and are labeled **AC IN** and **INV**. These buttons are special in that they can be pressed at any time anywhere in the MATE menu structure, and they take you to the same screens. For this reason they are referred to as 'hot' keys. Many common functions that need to be accessed often are found under the **AC IN** and **INV** button.

The four lower buttons under the LCD are called 'soft' keys and are used for navigating around the menus and changing values. Each 'soft' key has various functions dependent on the label directly above it on the lower line of the LCD.

The top line on the MATE usually displays the path or location of where you are in the menu system. The 2nd and 3rd lines of the MATE usually give you a description of what meter is being displayed or what parameter is currently set in the MATE. The bottom line on the MATE is almost exclusively used for labels to the four soft keys below. Each button below the bottom line of the MATE's display corresponds to the word directly above it.

This manual will denote soft key button presses as **<BUTTON>**, where **BUTTON** corresponds with the label displayed on the screen directly above the soft key.

NOTE: Pressing the left two buttons simultaneously from anywhere in the menu will return you to the MAIN menu screen.

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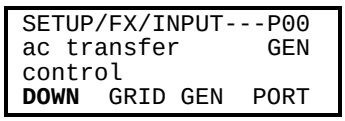
'SOFT' KEYS

The four buttons under the LCD are referred to as the 'soft' keys. Their operation is dependent on what their label says. The label is the word on the bottom line of the LCD directly above the button.

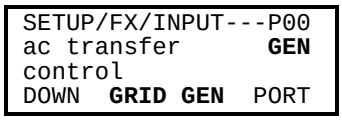
Soft keys used to navigate the menus are commonly labeled **<UP>**, **<DOWN>**, **<NEXT>**, **<BACK>**, or **<TOP>**.

Soft keys that change settings are labeled either with the change they will make, such as : **<OFF>**, **<AUTO>**, and **<ON>**, or if there are more than a couple values that the setting can be changed to, **<INC>** and **<DEC>** are used to mean *inc*rease and *dec*rease, respectively.

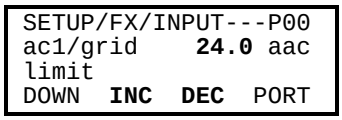


In this example, pressing **<DOWN>** will take you to the next set point screen in the SETUP/FX/INPUT menu.

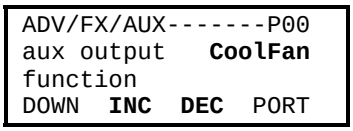
In this example, pressing **<TOP>** will take you to the first screen in the SETUP/FX/INPUT menu. **<SETUP>** will return you to the SETUP/FX screen, and **<MAIN>** will take you back to the Main screen.



In this example, pressing **<GRID>** will change the FX AC transfer control to **GRID** mode. Conversely, pressing **<GEN>** will change the FX AC transfer control to **GEN** mode.



In this example, pressing **<INC>** or **<DEC>** will change the numerical value of the **ac1/grid limit** setting.



In this example, there are multiple operating modes for the aux output function. Pressing **<INC>** or **<DEC>** will cycle through the available modes.

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Inverter Control

The OutBack MATE includes an **INV** "hot" key to allow direct control of the inverter from anywhere in the menu system. The **INV** key is located on the right side of the MATE LCD display. Pressing the **INV** key takes you to the INVERTER CONTROL menu shown below. A green LED indicator is located above the **INV** key which flashes when the inverter is either in the search or power save modes and is on continuously when full AC output voltage is available from the FX. When the inverter is turned off the green LED will not be illuminated.

INV

```
INVERTER CONTROL
currently:          ON

OFF   SRCH    ON     OK
```

Pressing the **INV** key once brings up the INVERTER CONTROL screen. To turn the inverter ON, press the key located below the word **<ON>**. Selecting **<SRCH>** will cause the inverter to begin operating in the search mode as long as the AC load connected is smaller than allowed by the programming of the search function. Selecting **<OFF>** turns off the inverters AC output signal.

Select **<OK>** to return to the point in the menu system from where you entered the INVERTER CONTROL screen.

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AC Input Control

The OutBack MATE includes a **AC IN** "hot" key to allow direct control of the AC input from anywhere in the menu system. The **AC IN** key is located on the left side of the MATE's LCD display. Above the **AC IN** key is a yellow LED indicator which flashes when an AC source is available but not connected, and is on continuously when the AC source is connected. If no AC source is available, the yellow LED indicator will remain off. The screens shown on this page apply to the "MATE", the "MATE B", and the "MATE 2" only.

AC IN

```
AC INPUT CONTROL
currently:       USE

DROP  USE         OK
```

Pressing the **AC IN** key once brings up the AC INPUT CONTROL screen. USE enables the inverter to connect to the AC source when it is available. DROP disconnects the AC source but will allow it to be reconnected if the battery gets too low or the inverter is overloaded.

AC IN AC IN

```
GEN START CONTROL
currently:    MAN-OFF

OFF  AUTO  ON     OK
```

Pressing the **AC IN** key a second time brings up the GEN START CONTROL screen. This allows operation of the generator either manually or automatically using the Advanced Generator Start (AGS) functions. The generators starting circuitry must be connected to the AUX ports of the control terminal block (see pages 12 & 13) to use this screen to manually turn the generator ON or OFF or to let the FX automatically perform the AGS functions. When the AGS functions have not been programmed, the screen will show MAN-OFF indicating that the generator is controlled manually and is OFF. Pressing the **<ON>** button will change the screen into MAN-ON and the generator will turn ON. To put this screen in AUTO mode, you must access the AGS SETUP menu. See your MATE manual for details.

AC IN AC IN AC IN

```
CHARGER CONTROL
currently:       AUTO

OFF   AUTO        OK
```

Pressing the **AC IN** key a third time brings up the CHARGER CONTROL screen. This allows operation of the battery charger to be preset for when an AC source is available. In AUTO mode the charger will start charging when an AC source connects to the FX or when the FX decides the batteries need charging. In OFF mode the charger stays off but the AC source is still passed through to the loads.

AC IN AC IN AC IN AC IN

```
CHARGER MODE CONTROL
global charger mode

BULK   EQ         OK
```

Pressing the **AC IN** key a fourth time brings up the **CHARGER MODE CONTROL** screen. This screen allows the MATE to issue system wide (global) charger commands. Both OutBack MX and FX products will respond to global charger commands if they are connected together through the HUB.

```
BULK CONTROL


START  STOP       OK
```

Pressing **<BULK>** brings up the **BULK CONTROL** screen, it will allow the user to start and/or stop a bulk charge cycle manually by pressing **<START>** or **<STOP>** respectively.

Pressing **<EQ>** brings up the **EQUALIZE CONTROL** screen.

When **<START>** has been selected, two informational screens are displayed. The user then must answer **<YES>** before an equalize charging cycle is allowed to begin.

Once the equalizing process has started, you can stop it at anytime by selecting **<STOP>** from this same control screen.

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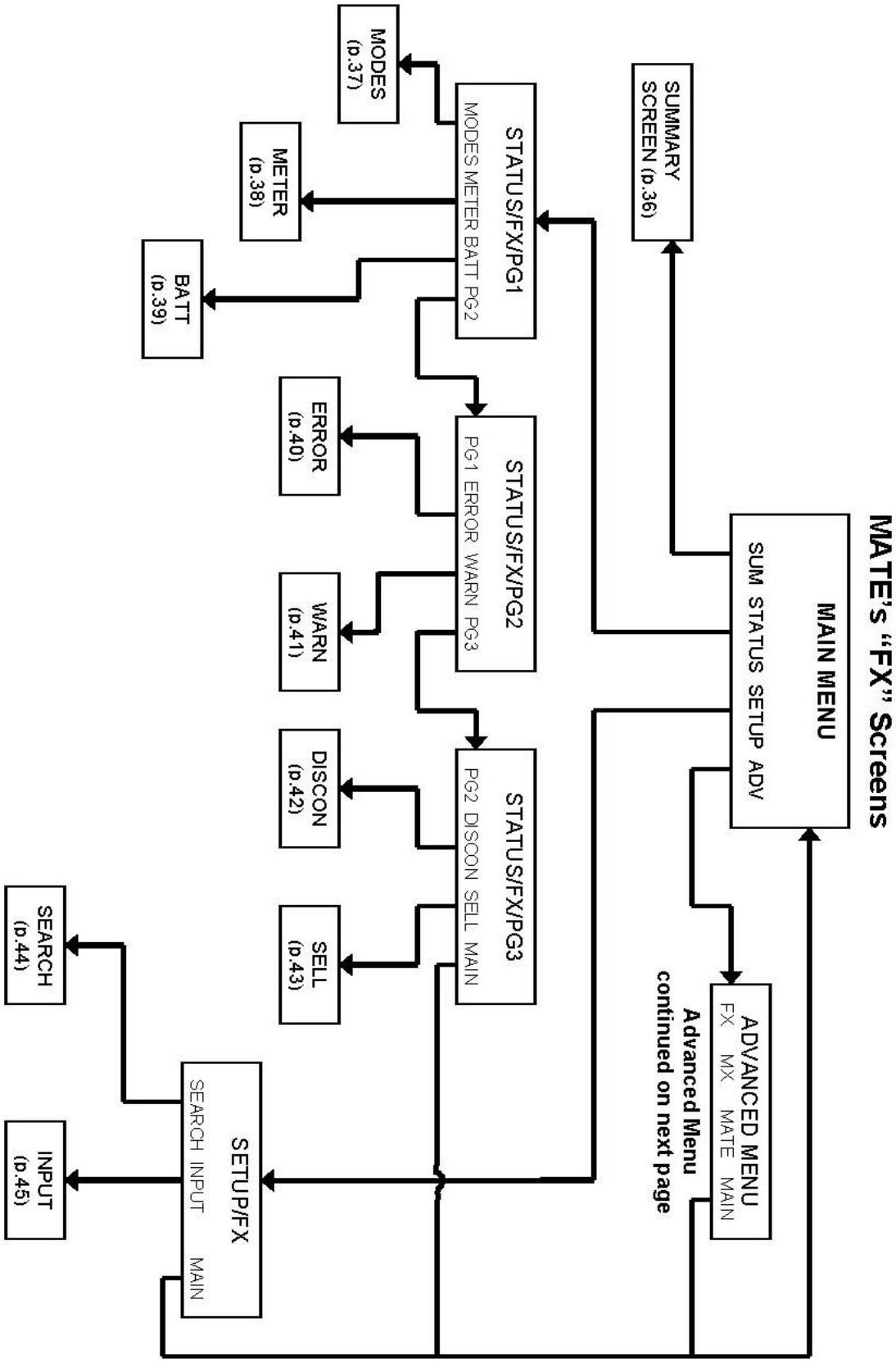

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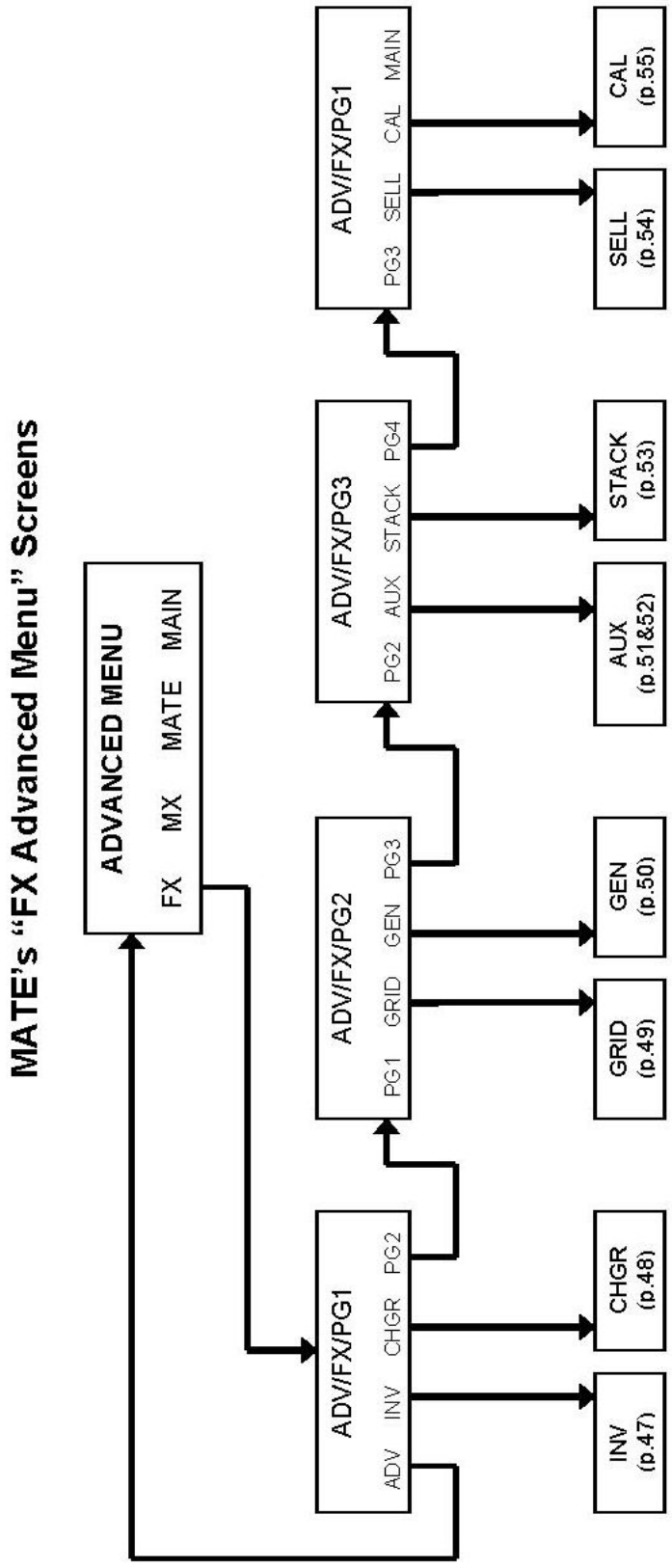
MATE's "FX Advanced Menu" Screens
ADVANCED MENU
FX MX MATE MAIN
ADV/FX/PG1
ADV INV CHGR PG2
ADV/FX/PG2
PG1 GRID GEN PG3
ADV/FX/PG3
PG2 AUX STACK PG4
ADV/FX/PG1
PG3 SELL CAL MAIN
INV (p.47)
CHGR (p.48)
GRID (p.49)
GEN (p.50)
AUX (p.51&52)
STACK (p.53)
SELL (p.54)
CAL (p.55)

Summary Screen

The OutBack MATE includes a **SUMMARY** screen to allow easy understanding of the FX operation. The display uses both words and symbols to show what currently is happening in the system, along with a limited amount of numbers. This makes it easier for the system user to understand where the power is flowing within the system. The first line of the summary screen displays "DC←→AC" and is measured in kilowatts (kW). This is to indicate the approximate AC power that is being both produced and consumed by all the FX's connected to the MATE (multiple FX's can be connected to one MATE through the HUB). Basically, it shows how much work the FX's are doing and relates to energy being transferred between the FX's and the batteries. The second line of the summary screen displays "AC Load" and has a light bulb symbol that appears for every 500 watts of power per FX that is being delivered to the AC loads (so 1 light bulb equals 1kW when two FX's are used with a single MATE through the HUB). The third line displays four different things depending of the status of the AC input. It displays "No ACIN" when the FX doesn't sense an AC source present. It displays "AC Drop" when an AC source is present but not connected. It displays "Buying" when an AC source is connected and the FX is using the source to charge or pass-through to the loads. In the third line, the symbol used to denote 500 watts or power per inverter is a dollar sign. The fourth line of the summary screen provides information about the battery (limited to battery voltage at this time).

To access the summary screen, press the button under the label **<SUM>** from the MAIN screen. Included below are some examples of different summary screens with an explanation of the information represented.

```
MAIN---------------
      6:54:42P

SUM STATUS SETUP ADV
```

↓

```
DC←→AC . . .  0.0kW
AC Load . . . . . .
No ACIN . . . . . .
Battery       12.8V
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

To access the summary screen, select SUM from the MAIN screen. A typical summary screen is shown here for a FX when the inverter is off and no AC source is connected.
The **battery voltage** is provided in the lower right corner of the display.

EXAMPLES

```
DC←→AC >>> .  1.4kW
AC Load ☼☼☼ . . . .
No ACIN . . . . . .
Battery       12.1V
```

INVERTING: The FX is inverting and producing AC output voltage which is powering 1.4kW of AC loads. No AC source is connected to the FX.

```
DC←→AC . . .  0.0kW
AC Load ☼☼ . . . . .
Buying  $$ . . . . .
Battery       12.6V
```

PASS-THROUGH: An AC source has been connected and the AC loads are drawing power from the AC source that is passing through the FX. The top line shows 0.0 kW indicating that the charger is in SILENT mode and is not charging the batteries. Approximately 1.0 kW loads are being powered from the AC source (assuming the system consists of one FX).

```
DC←→AC >>> .  1.7kW
AC Load ☼ . . . . .
Buying  $$$$. . . .
Battery       13.4V
```

BUYING (CHARGING & PASS-THROUGH): The FX is buying (four $ ≈ 2.0kW) more power than it is delivering to the loads (one ☼ ≈ 0.5kW). This is an indication that the FX is using the excess power to charge the batteries. The charger is charging at a rate of 1.7 kW of AC power going into the battery. The AC loads are low and are being powered from the AC source.

```
DC←→AC >>>>>  2.5kW
AC Load ☼☼☼☼☼ . . .
AC Drop . . . . . .
Battery       12.3V
```

AC DROP: The inverter is on and powering 2.5 kW of AC load from the batteries. The AC source is available but DROP was selected in the AC INPUT CONTROL. This will also be displayed when an AC source is available but not in use, such as during the initial time delay period once an AC source has been connected.

```
DC←→AC >>>>   2.2kW
AC Load ☼ . . . . .
Selling $$$ . . . .
Battery       13.4V
```

SELLING: The FX is selling power back to the utility grid at about 1.5kW. It is also supplying about 0.5kW of AC loads. The FX is taking about 2.2kW of power from the batteries. This excess battery power is coming from a different source (solar, wind, hydro, etc). This screen will only appear on "Grid-Tie" FX's.

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Status Screens

The **STATUS** screens allow the system user to check the operation of the FX system. Both AC voltage and AC current meters are provided to enable monitoring, adjustment and troubleshooting of the system operation.

MODES MENU

The **MODES** section lets the user view and change the various modes for a specific FX by pressing the PORT to access a specific FX. The modes include inverter, ac in, charger, auxiliary, and equalize. The operation of these modes can be changed by selecting the **CHANGE MODE** option on the screen. This is helpful if the user wishes to quickly enable or disable a particular function of a specific FX if necessary.

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

FX     MX
```

↓

```
STATUS/FX/PAGE1----
choose category:

MODES METER BATT PG2
```

↓

```
STATUS/FX/MODE--P00
inv control:      ON
         CHANGE
DOWN STAT  MODE PORT
```

↓

```
STATUS/FX/MODE--P00
ac in control:   USE
         CHANGE
DOWN  UP  MODE  PORT
```

↓

```
STATUS/FX/MODE--P00
chr control:    AUTO
         CHANGE
DOWN  UP  MODE  PORT
```

↓

```
STATUS/FX/MODE--P00
aux control:    AUTO
         CHANGE
DOWN  UP  MODE  PORT
```

↓

```
STATUS/FX/MODE--P00
eq enabled:       No
         CHANGE
      UP  MODE  PORT
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Selecting **<STATUS>** allows selection of the product type:

<FX>	FX inverter/charger system
MX	MX60 PV MPPT charge controller

<MODES>	Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
METER	Provides the AC voltages and currents of the FX
BATT	Provides the battery voltage and charger set points and timers
PG2	Displays additional sections – ERRORS, WARNINGS and PG3

The **INV CONTROL** screen lets you see the status of the inverter function of the FX. Pressing the STAT button returns you to the first page of the status menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the inverter OFF, turning the inverter ON, or putting the inverter into SEARCH. Pressing PORT will access the next FX if a HUB is present.

The **AC IN CONTROL** screen lets you see if the FX will accept an AC source at its input terminals. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of rejecting an AC source by pressing DROP or accepting an AC source by pressing USE. Pressing PORT will access the next FX if a HUB is present.

The **CHR CONTROL** screen lets you see what mode the charger is in. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the charger OFF or putting the charger into AUTO where it will follow the 5-stage charging algorithm. Pressing PORT will access the next FX if a HUB is present.

The **AUX CONTROL** screen lets you see the status of the auxiliary output. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the Aux OFF, turning the Aux ON, or putting the Aux into AUTO mode. In AUTO mode it will follow the "Aux Output Function" and its parameters that can be set in the Advanced (ADV) menu. Pressing PORT will access the next FX if a HUB is present.

The **EQ ENABLED** screen lets you see if the FX is in an equalize charging cycle and can also start or stop a cycle. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of START or STOP to initiate or cancel an equalize charge. Pressing PORT will access the next FX if a HUB is present.

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METER MENU

The **METER** section lets the user view the AC voltage and AC current meters as well as the software revision of the FX's microprocessor. The user can view the input and output AC voltages, as well as the input, inverter, charger and sell currents. This can be used to verify that the FX is sensing voltages and currents and also helps discern what the FX is doing (like charging or inverting). The software revision is helpful when troubleshooting. Some functions of certain software revisions are incompatible with older MATEs.

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

MODES	Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
<METER>	Provides the AC voltages and currents of the FX
BATT	Provides the battery voltage and charger set points and timers
PG2	Displays additional sections – ERRORS, WARNINGS and PG3

↓

```
Invert            P00
inv 0.0kw  zer 0.0kw
chg 0.0kw  buy 0.0kw
DOWN      STATUS PORT
```

This screen shows the mode and where power is flowing within the FX. The modes include **Invert**, **Charge**, **Pass Through**, **Support**, and **Sell**. When the FX is in the Invert, Support, or Sell mode, the **inv 0.0kw** meter will change. When the FX is in the Charge mode, the **chg 0.0kw** meter will change. The **zer 0.0kw** will change to **sel 0.0kw** and show a change when the FX is in the Sell mode. The **buy 0.0kw** meter will change when the FX is either in Pass Through or Charge mode.

↓

```
STATUS/FX/METER—-P00
output        230 vac
voltage
DOWN  UP  TOP   PORT
```

The **OUTPUT VOLTAGE** meter indicates the AC voltage on the AC output of the FX which is available to power the AC loads. When the inverter is in the SEARCH mode, the AC output voltage may not be the nominal output of 230 VAC. This is a normal condition – Increasing the AC load or selecting ON from the INVERTER CONTROL menu screen will return the AC output voltage to normal.

↓

```
STATUS/FX/METER—-P00
input         230 vac
voltage
DOWN  UP  TOP   PORT
```

The **INPUT VOLTAGE** meter indicates the AC voltage on the AC input of the FX system from an AC source, such as utility grid or back-up generator. When the FX is connected to an AC source, the input AC voltage will equal the output AC voltage. If the FX is not connected to the AC source the two voltages can differ significantly.

↓

```
STATUS/FX/METER—-P00
inverter      0.0 aac
current
DOWN  UP  TOP   PORT
```

The **INVERTER CURRENT** meter indicates the amount of current being supplied to the AC loads connected to the FX's AC output terminals when the inverter is ON and no AC source is connected. Each "aac" (amp AC) equals approximately 230 watts of load. When the FX system is connected to an AC source, this meter will read 0.

↓

```
STATUS/FX/METER--P00
charger       0.0 aac
current
DOWN  UP  TOP   PORT
```

The **CHARGER CURRENT** meter indicates the amount of AC current being used by the battery charger of the FX. Each "aac" (amp AC) equals approximately 230 watts of charge. This meter will read zero when the FX is not connected to an AC source.

↓

```
STATUS/FX/METER--P00
input         0.0 aac
current
DOWN  UP  TOP   PORT
```

The **INPUT CURRENT** meter indicates the total amount of current flowing into the AC input of the FX. Some of this power may be used by the battery charger with the remainder flowing through the AC transfer switch to the AC loads (Passing Thru). To estimate the amount of current being used by the AC loads, subtract the CHARGER INPUT current value from the INPUT CURRENT value.

↓

```
STATUS/FX/METER—-P00
sell          0.0 aac
current
DOWN  UP  TOP   PORT
```

The **SELL CURRENT** meter indicates the amount of AC current that the FX is pushing back into the utility grid. This screen is only operational on "Grid-Tie" FX models. Multiply this number by the INPUT VOLTAGE to get the power being sold back to the utility grid.

↓

```
STATUS/FX/METER—-P00
FX firmware        58
revision
DOWN  UP  TOP   PORT
```

This menu displays the **FX FIRMWARE REVISION** number for the software loaded into the FX's microcomputer. This may be required when troubleshooting or expanding your system. This is not the same as the software version in the MATE.

↓

```
STATUS/FX/METER—----
end of meter menu

      UP  TOP STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/METER menu section. Selecting STATUS returns to the STATUS screen.

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BATTERY MENU

The **BATTERY** menu section allows the user to check the status of the battery voltage and the battery charging process. Both the actual battery voltage and the temperature compensated battery voltage are provided. The battery charging process set points are displayed along with the associated timer for the charging process. No adjustments are allowed from this section. To change the battery charger's operation, go the ADVANCED programming section. The values displayed are not defaults.

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

MODES	Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
METER	Provides the AC voltages and currents of the FX
<BATT>	Provides the battery voltage and charger set points and timers
PG2	Displays additional sections – ERRORS, WARNINGS and PG3

```
STATUS/FX/BATT---P00
battery     12.2 vdc
actual
DOWN      STATUS PORT
```

Selecting **BATT** displays the **ACTUAL BATTERY** voltage measured by the FX. If the RTS battery temperature sensor is connected, then the actual battery voltage will probably not equal the temperature compensated battery voltage. When charging, the FX uses the temperature compensated battery voltage reading (next screen down).

```
STATUS/FX/BATT---P00
battery     12.2 vdc
temp compensated
DOWN  UP   TOP  PORT
```

This menu displays the **TEMPERATURE COMPENSATED BATTERY VOLTAGE** which is used by the battery charger for regulation. The Remote Temperature Sensor (RTS) must be connected to the Master FX for temperature compensation. If the RTS is connected then this value will be higher than the ACTUAL BATTERY VOLTAGE when the battery is hot and will be lower than the actual battery voltage when the battery is cold.

```
STATUS/FX/BATT---P00
absorb      14.4 vdc
set point
DOWN  UP   TOP  PORT
```

This is the battery charger set point for the absorb stage of the battery charging process. The voltage will be held at the **ABSORB VOLTAGE SET POINT** level for the ABSORB TIME LIMIT period that is set in the ADVANCED menu section. This value can only be changed in the ADVANCED menu.

```
STATUS/FX/BATT---P00
absorb      01.0 hrs
time remaining
DOWN  UP   TOP  PORT
```

The **ABSORB TIME REMAINING** is the period of time remaining for the absorb cycle. When the FX is performing an absorb charge this time value will start counting down once the absorb voltage has been reached. When this value reaches 0.0 hrs, the FX will go into SILENT (charger turns off) mode until the battery voltage drops to the FLOAT voltage.

```
STATUS/FX/BATT---P00
float       13.6 vdc
set point
DOWN  UP   TOP  PORT
```

This is the battery charger set point for the float stage of the battery charging process. After finishing the absorb charging stage the charger turns off and waits for the battery voltage to drop to the refloat voltage set point before the charger begins to float the battery. The voltage will be held at the **FLOAT VOLTAGE SET POINT** level for the float time period that is programmed in the next screen down.

```
STATUS/FX/BATT---P00
float       00.0 hrs
time remaining
DOWN  UP   TOP  PORT
```

The **FLOAT TIME REMAINING** is the amount of time remaining for the float stage of the battery charging process. The battery charger does not continuously float the batteries. It instead only floats for the FLOAT TIME LIMIT period set in the ADVANCED menu section. Once the time period has been met, the charger turns off (called SILENT on the SUMMARY screen). When the FX is in the "Float" charging stage, the "float time remaining" value appears and starts to count down.

```
STATUS/FX/BATT---P00
refloat     12.5 vdc
set point
DOWN  UP   TOP  PORT
```

The **REFLOAT SET POINT** is the battery voltage at which the battery charger will restart the float charging process and hold it there for the FLOAT TIME PERIOD. This setting is compared with the BATTERY ACTUAL voltage.

```
STATUS/FX/BATT---P00
equalize    14.4 vdc
set point
DOWN  UP   TOP  PORT
```

This is the battery charger set point for the equalize stage of the battery charging process. The voltage will be held at the **EQUALIZE VOLTAGE SET POINT** level for the equalize time period that is programmed in the ADVANCED menu section. The equalization process must be manually triggered while an AC source is connected to the FX's AC input. Equalize can be triggered by pressing the AC IN button four times, pressing the EQ button then selecting START.

```
STATUS/FX/BATT---P00
equalize    00.0 hrs
time remaining
DOWN  UP   TOP  PORT
```

The **EQUALIZE TIME REMAINING** is the amount of time remaining for the equalize stage of the battery charging process. Once the EQUALIZE TIME period has been met, the charger turns off. When the FX is in the "Equalize" charging stage, the "equalize time remaining" value appears and starts to count down.

```
STATUS/FX/BATT---P00
battery temp     255
(not in degrees C/F)
DOWN  UP   TOP  PORT
```

The **BATTERY TEMP** is a reference value used by the battery charger when an RTS is connected to the FX. A displayed value of 255 means the sensor is not connected or has been damaged. At normal room temperatures a value around 130 ± 15 will be shown. As the battery temperature increases, the value displayed will get lower and vice versa.

```
STATUS/FX/BATT------
end of battery menu

    UP  TOP  STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/BATT menu section. Selecting STATUS returns to the STATUS screen.

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ERROR MENU

The **ERROR** section allows the user to check the cause of an error condition. When an error has occurred, the red error LED indicator in the FX's wiring compartment will be illuminated (not to be confused with a blinking LED that indicates a WARNING). If an error occurs, the FX will cease operation and the MATE will display an error screen. Pressing **<VIEW ERROR>** from this screen brings the user to the 1st screen of a list of error causes that will be available by pressing the **DOWN** button. The presence of the word "YES" to the right of the appropriate cause indicates that this error has occurred. An error can be cleared by pressing the **<INV>** button on the MATE and then turning the FX **<OFF>** and then [back again to] **<ON>**. The inverter automatically resets from an over-temperature and low battery conditions.

```
MAIN---------------
      6:54:42P

SUM STATUS SETUP ADV
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```
STATUS--------------
choose product:

FX    MX
```

Allows selection of the product type:

<FX>	FX inverter/charger system
MX	MX60 PV MPPT charge controller

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

MODES	Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
METER	Provides the AC voltages and currents of the FX
BATT	Provides the battery voltage and charger set points and timers
<PG2>	Displays additional sections – ERRORS, WARNINGS and PG3

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

PG1	Returns to page 1 of the STATUS section
<ERROR>	Displays the different causes for errors and qualifies each cause with a Yes or No
WARN	Displays the different causes for warnings and qualifies each with a Yes or No
PG3	Displays additional sections – reason for last DISCONNECT and SELL

```
STATUS/FX/ERROR—-P00
low ac output     No
voltage
DOWN      STATUS PORT
```

LOW OUTPUT AC VOLTAGE indicates that the inverter was not able to maintain adequate AC output voltage (200 VAC or above) to power the loads connected. This typically is caused by the load demanding more power than the inverter is able to deliver.

```
STATUS/FX/ERROR—-P00
stacking          No
error detected
DOWN  UP   TOP  PORT
```

STACKING ERROR DETECTED indicates that a problem has occurred with the communication cabling between stacked FX's, or if the FX's are stacked incorrectly. Check the stacking programming. If this condition persists contact your dealer for servicing instructions.

```
STATUS/FX/ERROR—-P00
inverter          No
overtemp
DOWN  UP  TOP   PORT
```

INVERTER OVERTEMP indicates that the FX reached its maximum allowed operating temperature. This can be caused by powering large AC loads or charging for too long. It can also be caused by restricting the amount of air which is able to flow around the casting or operation in high temperature environments. The inverter will automatically reset and resume operation once it cools down.

```
STATUS/FX/ERROR—-P00
low battery       No
voltage
DOWN  UP  TOP   PORT
```

LOW BATTERY VOLTAGE indicates that the battery voltage dropped below the LOW BATTERY CUT-OUT VOLTAGE set point (10.5 volts for a 12 volt FX) for 5 minutes. The inverter will restart once the battery voltage exceeds the LOW BATTERY CUT-IN VOLTAGE set point (12.5 volts for a 12 volt FX) for 10 minutes.

```
STATUS/FX/ERROR—-P00
phase loss        No
error
DOWN  UP  TOP   PORT
```

PHASE LOSS ERROR is not operational at this time. If a 'Yes' accompanies this Error, please disregard.

```
STATUS/FX/ERROR—-P00
high battery      No
voltage
DOWN  UP  TOP   PORT
```

HIGH BATTERY VOLTAGE indicates that the battery voltage rose above the high battery voltage level (20 volts for a 12 volt FX) for 10 seconds. The inverter will restart once the battery voltage drops below the high battery voltage level (20 volts for a 12 volt FX) for 1 second.

```
STATUS/FX/ERROR—-P00
ac output         No
shorted
DOWN  UP  TOP   PORT
```

AC OUTPUT SHORTED indicates that the inverter immediately reached its maximum current and shut down. This is usually caused by a short circuit condition (hence the AC OUTPUT SHORTED label) but can also be caused by attempting to operate a load which far exceeded the inverter output capability.

```
STATUS/FX/ERROR—-P00
ac output         No
backfeed
DOWN  UP  TOP   PORT
```

AC OUTPUT BACKFEED indicates that another AC source of power was connected to the AC output of the FX. Usually this is an installation issue. It often occurs when there is an X-240 transformer in the system, and the FX's haven't been programmed for stacking. Programming the FX's for the correct stacking may erase this error.

```
STATUS/FX/ERROR—-P00
end of error menu
      UP  TOP STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/ERROR menu section. Selecting STATUS returns to the first page of the STATUS screen.

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WARNINGS MENU

The **WARNINGS** section of the STATUS menu allows the user to check the cause of a warning condition for the FX. When a warning condition has occurred, the red "ERROR" LED indicator in the FX's wiring compartment will flash. The cause of the warning will not be immediately displayed on the MATE like an ERROR will. Instead, you must access this WARNINGS menu and scroll down the list to find out which warning is present. This is indicated by the presence of a YES next to the appropriate cause listed. Once the warning has been cleared, the display will change back to NO as shown below and the red LED will stop flashing. A warning will not shut the FX down like an error will.

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

↓

```
STATUS/FX/WARN---P00
acin freq        No
too high
DOWN     STATUS PORT
```

↓

```
STATUS/FX/WARN---P00
acin freq        No
too low
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
acin voltage     No
too high
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
acin voltage     No
too low
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
ac input         No
current exceeds max
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
temperature      No
sensor fault
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
internal comm    No
error detected
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
internal fan     No
failure detected
DOWN  UP   TOP  PORT
```

↓

```
STATUS/FX/WARN---P00
airtemp          206

DOWN  UP        PORT
```

↓

```
STATUS/FX/WARN---P00
fettemp          200

DOWN  UP        PORT
```

↓

```
STATUS/FX/WARN---P00
captemp          203

DOWN  UP        PORT
```

↓

```
STATUS/FX/WARN------
end of warnings
menu
     UP   TOP STATUS
```

PG1	Returns to page 1 of the STATUS section
ERROR	Displays the different causes for errors and qualifies each cause with a Yes or No
<WARN>	Displays the different causes for warnings and qualifies each with a Yes or No
PG3	Displays additional sections – reason for last DISCONNECT and SELL

AC IN FREQUENCY TOO HIGH indicates that the FX is approaching the upper limit of its frequency window and will drop the AC source if the frequency gets much higher. If the frequency of the AC source is above 55 Hz, the FX will display this warning.

AC IN FREQUENCY TOO LOW indicates that the FX is approaching the lower limit of its frequency window and will drop the AC source if the frequency gets much lower. If the frequency of the AC source is below 45 Hz, the FX will display this warning.

AC IN VOLTAGE TOO HIGH indicates that the AC source's voltage is over the upper limit (default is 270 VAC) of its voltage window. If an AC source was just applied to the FX, the FX will not connect to the AC source until the voltage drops below the upper limit.

AC IN VOLTAGE TOO LOW indicates that the AC source's voltage is below the lower limit (default is 208 VAC) of its voltage window. If an AC source was just applied to the FX, the FX will not connect to the AC source until the voltage rises above the lower limit.

AC INPUT CURRENT EXCEEDS MAX indicates that the AC loads are drawing more current than the rating of the FX allows. Exceeding this current limit for an extended period of time could cause the FX to fail. Reduce the loads on the FX's AC output to prevent damage and make sure a 30A max breaker is used on the AC input line.

TEMPERATURE SENSOR FAULT indicates that one of the temperature sensors internally located in the FX is not working correctly. The FX needs to be checked by a qualified repair technician. The AIRTEMP, FETTEMP and CAPTEMP warnings listed below can help with troubleshooting.

INTERNAL COMMUNICATION ERROR DETECTED indicates that a communication problem has occurred between the MATE and the FX. This warning may occur if the communication lines between the FX and the MATE have been severed. If this is the case, turn the FX off and then on through the DC disconnect. If this does not solve the problem, call OutBack for assistance.

INTERNAL FAN FAILURE DETECTED warns that the fan mounted above the transformer inside the FX has stopped working or is not functioning properly. This will eventually cause an INVERTER OVERTEMP error if the cause of the fan failure is not fixed. Restart the FX and listen for the fan to verify a fan failure. The fan should run for about 15 seconds on start-up.

AIRTEMP shows a numerical value that the FX understands as a temperature. The value comes from a sensor inside the FX that measures the temperature of the air. This warning is given for troubleshooting purposes.

FETTEMP shows a numerical value that the FX understands as a temperature. The value comes from a sensor inside the FX that measures the temperature of the FET's (Field Effect Transistors). This warning is given for troubleshooting purposes.

CAPTEMP shows a numerical value that the FX understands as a temperature. The value comes from a sensor inside the FX that measures the temperature of the ripple capacitors. This warning is given for troubleshooting purposes.

Selecting TOP returns the user to the top of the STATUS/FX/WARN menu section. Selecting STATUS returns to the STATUS screen to allow selection of another product.

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DISCONNECT MENU

The FX includes a section that displays the reason for last **DISCONNECT** from the AC source. This is helpful if the FX rejects the AC source and the user wants an explanation and help on rectifying the problem. The FX will disconnect from an AC source if the AC source falls out of the FX's frequency or voltage ranges. If the AC source disconnects from the FX and none of the reasons for disconnect are followed by a "Yes" it is possible that the AC source shut itself down (this is sometimes the case with smaller generators, or generators with an internal temperature "shutdown" switch).

```
MAIN---------------
      6:54:42P

SUM STATUS SETUP ADV
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```
STATUS--------------
choose product:

FX    MX
```

Allows selection of the product type:

<FX>	FX inverter/charger system
MX	MX60 PV MPPT charge controller

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

MODES	Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
METER	Provides the AC voltages and currents of the FX
BATT	Provides the battery voltage and charger set points and timers
<PG2>	Displays additional sections – ERRORS, WARNINGS and PG3

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

PG1	Returns to page 1 of the STATUS section
ERROR	Displays the different causes for errors and qualifies each cause with a Yes or No
WARN	Displays the different causes for warnings and qualifies each with a Yes or No
<PG3>	Displays additional sections – reason for last DISCONNECT and SELL

```
STATUS/FX/PAGE3-----
choose category:

PG2 DISCON SELL MAIN
```

PG2	Displays additional sections – ERRORS, WARNINGS and PG3
<DISCON>	Displays the reason that the FX last disconnected from the AC source
SELL	Displays the code related to the reason for the last disconnection while selling
MAIN	Returns the user to the MAIN menu

```
STATUS/FX/DISCON-P00
acin freq        No
too high
DOWN     STATUS PORT
```

The **ACIN FREQ TOO HIGH** screen displays a "Yes" if the FX gets disconnected from the AC source due to the frequency of the AC source exceeding 59 Hz. The MATE does not display the frequency of the AC source, but this can be verified using an oscilloscope. If this message occurs and the AC source is a generator, it may be possible to adjust the frequency of the generator.

```
STATUS/FX/DISCON-P00
acin freq        No
too low
DOWN  UP  TOP   PORT
```

The **ACIN FREQ TOO LOW** screen displays a "Yes" if the FX disconnected from the AC source due to the frequency of the AC source being below 41 Hz. The MATE does not display the frequency of the AC source, but this can be verified using an oscilloscope. If this message occurs and the AC source is a generator, it may be possible to adjust the frequency of the generator.

```
STATUS/FX/DISCON-P00
acin voltage     No
> max
DOWN  UP  TOP   PORT
```

The **ACIN VOLTAGE > MAX** screen indicates that the AC source's voltage exceeded the maximum AC voltage the FX allows (270 vac default). This value can be adjusted in the ADVANCED menu, in the GRID or GEN sections (depending on your input type). The FX disconnects to protect the loads from high voltage. If you expect significant voltage drop due to long cable runs, it may be safe to raise the limit.

```
STATUS/FX/DISCON-P00
acin voltage     No
< min
DOWN  UP  TOP   PORT
```

The **ACIN VOLTAGE < MIN** screen indicates that the AC source's voltage is below the minimum AC voltage the FX allows (208 vac default). This value can be adjusted in the ADVANCED menu, in the GRID or GEN sections (depending on your input type). The FX disconnects to protect the loads from low voltage. If your AC source operates near this voltage limit, it could affect the charging function (the FX backs off the charger if the AC voltage reaches the lower limit) and adjusting the limit lower may be in order.

```
STATUS/FX/DISCON----
end of DISCON menu

      UP  TOP STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/DISCON menu section. Selecting STATUS returns to the STATUS screen to allow selection of another product.

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SELL MENU

The **SELL** section of the STATUS menu has only one screen. This screen gives a number that refers to a reason the FX would stop selling. OutBack Power Systems technicians use this number to quickly understand what the FX thinks is happening. The system user should not be concerned about this number unless they are experiencing many unknown grid disconnects and they need troubleshooting help. This screen is only operational with "Grid-Tie" FX's.

```
MAIN---------------
      6:54:42P

SUM STATUS SETUP ADV
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```
STATUS-------------
choose product:

FX     MX
```

Allows selection of the product type:

<FX>	FX inverter/charger system
MX	MX60 PV MPPT charge controller

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

MODES	Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
METER	Provides the AC voltages and currents of the FX
BATT	Provides the battery voltage and charger set points and timers
<PG2>	Displays additional sections – ERRORS, WARNINGS and PG3

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

PG1	Returns to page 1 of the STATUS section
ERROR	Displays the different causes for errors and qualifies each cause with a Yes or No
WARN	Displays the different causes for warnings and qualifies each with a Yes or No
<PG3>	Displays additional sections – reason for last DISCONNECT and SELL

```
STATUS/FX/PAGE3-----
choose category:

PG2 DISCON SELL MAIN
```

PG2	Displays additional sections – ERRORS, WARNINGS and PG3
DISCON	Displays the reason that the FX last disconnected from the AC source
<SELL>	Displays the code related to the reason for the last disconnection while selling
MAIN	Returns the user to the MAIN menu

```
STATUS/FX/SELL---P00
stop sell        14
reason
STATUS          PORT
```

The **STOP SELL REASON** displays a numerical value that indicates a reason that the FX stopped selling to the utility grid. It could indicate that the utility grid's voltage or frequency is out of the acceptable ranges or that the utility grid failed altogether. This screen is used for troubleshooting by OutBack Power Systems technicians. Selecting STATUS returns the user to the beginning of the STATUS menu. Selecting PORT selects the next FX on the HUB.

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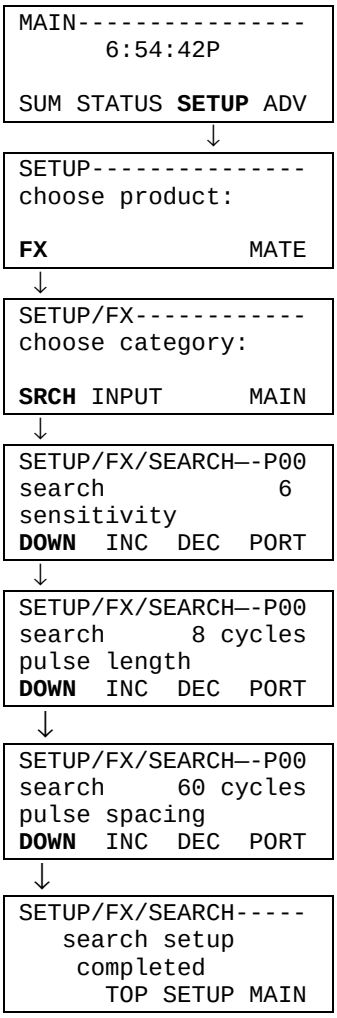
Setup Screens

The OutBack FX includes a **SETUP** menu to allow limited adjustment of some of the settings which may need to be accessed by the system user.

SEARCH MENU

The **SEARCH** mode is an automatic system which reduces the power consumption of the FX during periods of no power demand. It is primarily used for off-grid applications where the power is being generated by solar panels or other renewable energy sources and the system user is concerned about conserving every possible watt of power. Properly setup and operated, SEARCH mode can save considerable amounts of power compared to keeping an inverter in the ON mode 24 hours a day.

The FX includes a load detection method that is called "search mode" in which the inverter produces a pulsed AC output to detect the magnitude of the AC load which is connected to the inverter AC output. Once a large enough load has been turned on, the inverter resumes normal operation providing continuous AC power. If the AC load is reduced to a level below the SEARCH SENSITIVITY setting, then the inverter turns off and the pulsed AC output (search mode) is resumed. The power saved by using the SEARCH pulsing method comes both from the reduced consumption of the inverter itself and from the elimination of the power consumed by "phantom" AC loads – appliances which consume power even though they are not operating. The SEARCH SENSITIVITY setting can be adjusted to ignore small AC loads such as a VCR display, etc. Use of the search mode requires some tuning of the settings for the particular loads connected and may not work well with some loads such as fluorescent lights with magnetic ballasts.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

<FX>	FX inverter/charger system
MATE	MATE system display and user interface

The categories are then displayed for the settings which can be adjusted in the setup menu.

<SRCH>	Allows adjustment of the settings for the Search mode.
INPUT	Allows selection of the AC INPUT and current limit adjustment.
MAIN	Returns the display to the MAIN screen.

The **SEARCH SENSITIVITY** setting determines how much AC load (watts) is required to make the FX switch from the 'search' mode to the normal inverter 'on' mode. Increasing the number (INC) decreases the sensitivity (more watts must be turned 'on' to bring the FX out of 'search') while decreasing the number (DEC) increases the sensitivity (less watts must be turned 'on' to bring the FX out of 'search'). Adjusting this setting to zero will effectively disable the search mode operation.

The **SEARCH PULSE LENGTH** setting determines the number of pulses produced by the inverter in quick succession (actually AC cycles) which are used to detect the level of the AC load connected. Some AC loads do not draw much power from a single AC pulse – setting this value to 8 or more pulses may allow the AC load to be detected more reliably. This setting has a range between 4 cycles and 20 cycles in 1 cycle increments.

The **SEARCH PULSE SPACING** is the amount of time (in number of AC cycles) that the inverter waits before producing additional AC pulses to sense a load. The larger this 'search pulse spacing' number is, the lower the power consumption of the FX, but the more noticeable the delay between when the AC load is turned 'on' and when it actually comes 'on'. This setting has a range between 4 cycles and 120 cycles (2 seconds) in 1 cycle increments.

Selecting TOP returns the user to the top of the SETUP/FX/SEARCH menu section. Selecting SETUP returns you to the setup screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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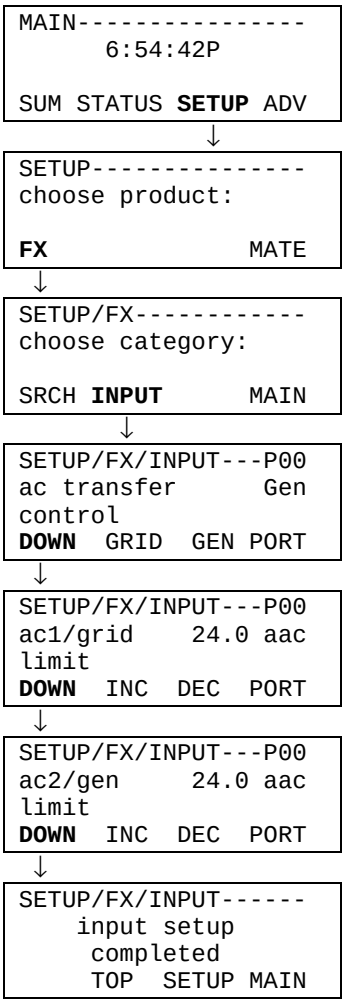
INPUT MENU

The other settings currently accessible to the system user in the SETUP menu involve the AC **INPUT**. The system user can specify what type of AC INPUT is being used, whether it is a generator (GEN) or the utility grid (GRID). Following this are two screens, one for GEN and one for GRID, that allow the user to adjust the maximum AC current that the FX will allow to enter before the FX gives a warning.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

<FX>	FX inverter/charger system
MATE	MATE system display and user interface

The categories are then displayed for the settings which can be adjusted in the setup menu.

SRCH	Allows adjustment of the settings for the Search mode.
<INPUT>	Allows selection of the AC INPUT and current limit adjustment.
MAIN	Returns the display to the MAIN screen.

The **AC TRANSFER CONTROL** screen lets the user select the type of AC input which is connected to the FX. This is used to choose the source of the AC input entering the FX. The two choices are GRID for the utility grid or GEN for a generator. The settings for the AC source are found in the advanced menu under the headings GRID and GEN (see next page).

The **AC1/GRID LIMIT** is the maximum amount of current that the FX will allow to be drawn by AC loads and battery charger together from the utility grid. When this limit is reached the charger will be "backed off" to keep from overloading the utility grid. This setting has a range between 2.5 aac and 30.0 aac in 0.5 aac increments.

The **AC2/GEN LIMIT** is the maximum amount of current that the FX will allow to be drawn by AC loads and battery charger together from the generator. When this limit is reached the charger will be "backed off" to keep from overloading the generator. This setting has a range between 2.5 aac and 30.0 aac in 0.5 aac increments.

Selecting TOP returns the user to the top of the SETUP/FX/INPUT menu section. Selecting SETUP returns you to the setup screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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Advanced Screens

The **ADVANCED** (ADV) menu section allows adjustment of all the settings involved with the operation of the FX. Changes made to these settings are stored internally in non-volatile memory inside of the FX – the settings are not lost when the MATE is removed or battery power is disconnect.

Some settings appear both in the SETUP and in the ADV menus. Changes made to these settings in one area will cause the same changes to occur in the other area. The settings are provided in both menus to make it more convenient for the FX programmer by giving access to all of the settings in the advanced menu.

Access to the settings in the ADV menu is restricted through the use of a password. This password is required to view and adjust the settings. Once the password has been entered, all advanced categories can be adjusted without having to re-enter the password. If the advanced menu is exited and re-entered, the password must be re-entered, however. Use of the "hot" keys AC IN and INV is allowed from the advanced menu and selecting OK from these screens will return you to the same point in the advanced menu.

The password for the inverter is currently fixed to the same value for all of the FX's.

PASSWORD CODE: 1 4 1

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

Selecting **<ADV>** brings up a warning message. Please read the message. Pressing any of the four keys below the display advances the display to the password screen.

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

Entering the correct password number is done by pressing the **<INC>** key to increase the number or the **<DEC>** key to decrease the number. Once the number shown matches the password code **(141)**, press the key below the word **<ENTER>**. To leave the advanced menu area without making any changes, press EXIT.

```
ADV-----------------
choose product:

FX    MX  MATE  MAIN
```

Following the password screen is a screen that allows selection of the OutBack product type. Selecting **<FX>** allows adjustment of the FX's advanced programming. Selecting MX will allow access to the advanced sections of any MX-60's connected to the system (through a HUB). Selecting MATE will allow access to the MATE's advanced screens. Selecting MAIN returns the user to the MAIN menu.

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR  PG2
```

There are eight categories of settings in the FX:

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID   GEN  PG3
```

```
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
```

```
ADV/FX/PAGE3--------
choose category:

PG3  SELL  CAL  MAIN
```

INV	Allows adjustment of the INVERTER settings and operation
CHGR	Allows adjustment of the CHARGER settings and operation
GRID	Allows adjustment of the AC input settings and operation if the FX's input is set to GRID
GEN	Allows adjustment of the AC input settings and operation if the FX's input is set to GEN
AUX	Allows adjustment of the AUX OUTPUT settings and operation
STACK	Allows adjustment of the master/slave settings for multi-FX systems
SELL	Allows adjustment of the Grid-Tie settings and operation
CAL	Allows adjustment of the voltage calibration measurements to improve operation

Selecting ADV will send the user back one screen to the "choose product" screen in the advanced menu. PG2 will advance the user to page 2 of the advanced menu. PG3 will advance the user to page 3 of the advanced menu. PG4 will advance the user to page 4 of the advanced menu. Selecting MAIN will return the user to the MAIN screen.

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INVERTER MENU

The **INVERTER** category of the advanced menu section allows adjustment of the inverter's operation to match the AC load and battery requirements. Specifically, this section allows adjustment of the 'Search' function, the low battery cut-out function, the FX's AC output voltage, and allows the user to reset the FX to its factory defaults.

```
ADV----------------
choose product:

FX    MX  MATE  MAIN
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT menu is displayed. Selecting **<FX>** allows adjustment of the FX's advanced programming.

```
ADV/FX/PAGE1--------
choose category:

ADV  INV   CHGR  PG2
```

Selecting **<INV>** allows adjustment of the FX's inverter set points and operation.

```
ADV/FX/INVERTER—-P00
search           6
sensitivity
DOWN  INC  DEC
```

The **SEARCH SENSITIVITY** setting determines how much AC load is required to make the FX switch from the 'search' mode to the normal inverter 'on' mode. Increasing the number (INC) decreases the sensitivity (more power must be turned 'on' to bring the FX out of 'search') while decreasing the number (DEC) increases the sensitivity (less power must be turned 'on' to bring the FX out of 'search'). Adjusting this setting to zero will effectively disable the search mode operation.

```
ADV/FX/INVERTER—-P00
search      8 cycles
pulse length
DOWN  INC  DEC
```

The **SEARCH PULSE LENGTH** setting determines the number of pulses produced by the inverter in quick succession (actually AC cycles) which are used to detect level of AC load connected. Some AC loads do not draw much power from a single AC pulse – setting this value to 8 or more pulses may allow the AC load to be detected more reliably. This setting has a range between 4 cycles and 20 cycles in 1 cycle increments.

```
ADV/FX/INVERTER—-P00
search     60 cycles
pulse spacing
DOWN  INC  DEC
```

The **SEARCH PULSE SPACING** is the number of AC cycles that the inverter waits before producing additional AC pulses. The larger this 'search pulse spacing' number is, the lower the power consumption, but the more noticeable the delay becomes when an AC load is first turned on. This setting has a range between 4 cycles and 120 cycles (2 seconds) in 1 cycle increments.

```
ADV/FX/INVERTER—-P00
low battery 10.5 vdc
cut-out set point
DOWN  INC  DEC
```

The **LOW BATTERY CUT-OUT** setting determines when the inverter will turn off to prevent over discharge of the battery system. If an AC source is available and the AC INPUT was set to DROP, the FX will transfer all of the AC loads on the inverter to the AC source. A fixed delay of 5 minutes is included to reduce nuisance inverter shutdowns. This setting has a range between 9.0 vdc and 12.0 vdc in 0.1 vdc increments.

```
ADV/FX/INVERTER—-P00
low battery 12.5 vdc
cut-in set point
DOWN  INC  DEC
```

The **LOW BATTERY CUT-IN** setting determines when the inverter will turn back on after it had shut off due to a low battery situation. A fixed delay of 10 minutes is provided to reduce the possibility of the system cycling on and off. This setting has a range between 10.0 vdc and 14.0 vdc in 0.1 vdc increments.

```
ADV/FX/INVERTER—-P00
adjust       230 vac
output voltage
DOWN  INC  DEC
```

The **ADJUST OUTPUT VOLTAGE** setting allows the user to change the output voltage to a lower or higher voltage. This may be necessary if some loads are far away from the FX or if some loads are sensitive to higher voltages. This setting has a range between 210 vac and 240 vac in 2 vac increments.

```
ADV/FX/INVERTER-----
reset FX to factory
 defaults
DOWN            MORE
```

The **RESET FX TO FACTORY DEFAULTS** changes all of the settings in the FX back to the factory default set points. **THIS WILL CAUSE ALL OF THE PREVIOUS PROGRAMMING TO BE LOST**. Selecting MORE displays a screen that allows the user to select which port on the HUB that the FX to be reset is on. Once the user has chosen the PORT, or if there is not a HUB, the user should press NEXT to proceed. To complete the reset to factory defaults, the user must press 1 and then 2.

```
ADV/FX/INVERTER-----
inverter programming
    completed
      TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/INVERTER menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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CHARGER MENU

The **CHARGER** section allows for adjustment of the battery charger's operation to match the requirements of the batteries used. OutBack's default battery charging set points may not be correct for the type of batteries being used. Please contact the battery manufacturer for correct ABSORB, FLOAT and EQUALIZE voltages. See the BATTERY CHARGING INSTRUCTIONS on page 24 for guidelines on how to set some of these values. The FX's battery charger includes five stages. BULK raises the battery voltage to the 'Absorb Setpoint'. ABSORB sustains the battery voltage for the 'Absorb Time Limit'. The charger then goes into SILENT mode (no charging) until the battery voltage drops to the 'Refloat Setpoint'. Then the FX goes into FLOAT and sustains the 'Float Setpoint' voltage for the 'Float Time Period'. The charger then goes into SILENT mode and repeats the FLOAT cycle when the battery voltage drops to the 'Refloat Setpoint'. There are additional screens for "Equalize Setpoint' and 'Equalize Time Period'. An equalize charge must be manually started. The time limits that it spends in the various stages are adjustable to provide control and maximize the performance of the battery charger and battery system.

```
ADV----------------
choose product:

FX               MATE
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting **<FX>** allows adjustment of the FX's advanced programming.

↓

```
ADV/FX/PAGE1--------
choose category:

ADV  INV   CHGR  PG2
```

Selecting **<CHGR>** allows adjustment of the battery charger set points and operation.

↓

```
ADV/FX/CHARGER---P00
charger      4.0 aac
limit
DOWN  INC  DEC  PORT
```

The **CHARGER LIMIT** is the maximum amount of AC current that will be used by the FX to power the battery charger. In most systems this setting will not need to be changed. This setting has a range as low as 0.0 aac and as high as 6.0 aac to 10.0 aac (depending on the model) in 0.5 aac increments.

↓

```
ADV/FX/CHARGER---P00
absorb      14.4 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **ABSORB SET POINT** is the voltage that the batteries will be charged to during the first stage of the charging process. This stage of charging raises the battery voltage higher than the nominal battery voltage and allows the batteries to regain their charge. The 'Absorb Time Limit' must be long enough for the batteries to regain 100% of their charge. This setting has a range between 13.0 vdc and 16.0 vdc in 0.1 vdc increments.

↓

```
ADV/FX/CHARGER---P00
absorb      01.0 hrs
time limit
DOWN  INC  DEC  PORT
```

The **ABSORB TIME LIMIT** can be adjusted to provide enough time at the 'Absorb Setpoint' to achieve a fully recharged battery. For large batteries a longer time may be required – small batteries may require a lower setting. The FX automatically reduces the 'Absorb Time Limit' when the charger is connected to a partially charged battery. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

↓

```
ADV/FX/CHARGER---P00
float       13.6 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **FLOAT SET POINT** is the voltage that the batteries will be 'trickle' charged to. This charge will finish the charging process by putting the last few percentage points of charge into the batteries. This set point can be adjusted to match the specific requirements of the batteries being charged. This setting has a range between 12.0 vdc and 15.0 vdc in 0.1 vdc increments.

↓

```
ADV/FX/CHARGER---P00
float       01.0 hrs
time period
DOWN  INC  DEC  PORT
```

The **FLOAT TIME PERIOD** can be adjusted to set the amount of time that the battery is held at the 'Float Setpoint'. For large batteries a longer time may be required – smaller batteries may use a lower setting. Once the battery has been held at the 'Float Setpoint' for the 'Float Time Period', the battery charger goes silent and provides no charge to the battery. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

↓

```
ADV/FX/CHARGER---P00
refloat     12.5 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **REFLOAT SET POINT** voltage is used to "trigger" the battery charger back into another FLOAT cycle when the battery voltage falls to this set point. This can provide maintenance charging of batteries and is also useful when intermittent DC loads are operated from a battery system and an AC source is available. This setting has a range between 12.0 vdc and 13.0 vdc in 0.1 vdc increments.

↓

```
ADV/FX/CHARGER---P00
equalize    14.4 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **EQUALIZE SET POINT** voltage can be set for a high voltage to de-stratify the batteries on occasion. The user can start an equalization charge through the AC IN "hot" key. The batteries must be supervised throughout the equalization process. Consult the battery supplier as to specific instruction on the battery equalizing process. This setting has a range between 14.0 vdc and 17.0 vdc in 0.1 vdc increments.

↓

```
ADV/FX/CHARGER---P00
equalize    01.0 hrs
time period
DOWN  INC  DEC  PORT
```

The **EQUALIZE TIME PERIOD** can be adjusted to limit the amount of time that the battery is equalized. The timer starts to advance once the battery voltage exceeds the absorb voltage set point. Once the timer reaches the equalize time period, the charger goes into the silent stage of the charging process. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

↓

```
ADV/FX/CHARGER------
charger programming
     completed
      TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/CHARGER menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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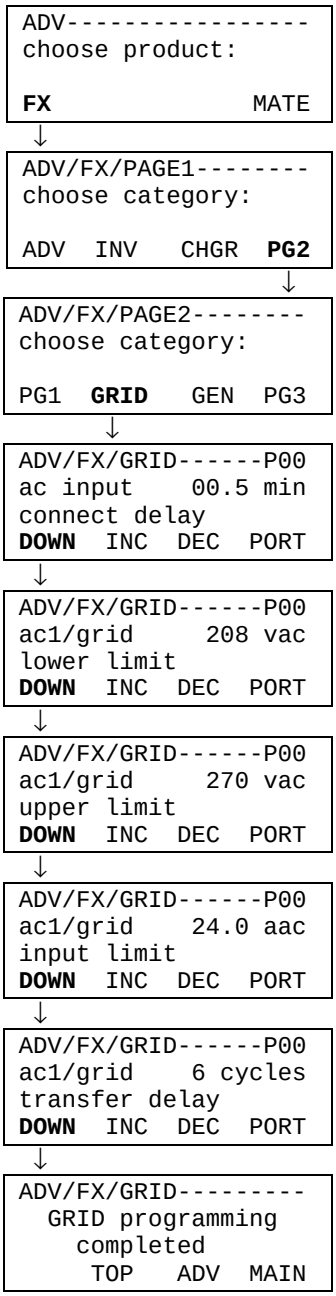
GRID MENU

The **GRID** category of the advanced menu section allows for adjustment of the AC input voltage window and time delays to match the characteristics of the AC source if that AC source is the utility grid. This setting can be found in the SETUP/FX/INPUT menu. All OutBack Power System FX's other than the "Grid-Tie" FX's have a default of GEN (generator) as the AC source. If the AC source is the utility grid, return to the SETUP/FX/INPUT section (page 45) and change the 'AC Transfer Control' screen to GRID.



Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting **<FX>** allows adjustment of the FX's advanced programming.

Selecting **<PG2>** advances the user to the second page of the advanced menu.

Selecting **<GRID>** allows adjustment of the AC input set points and operation.

The **AC INPUT CONNECT DELAY** set point adjusts the time period of when the FX sees an acceptable AC source to when it connects the AC loads to that source. This is useful to allow the utility grid to become stable after a utility power outage. This setting has a range between 0.2 minutes to 15 minutes in 0.1 minute increments.

The **AC1/GRID LOWER LIMIT** set point allows adjustment of the minimum voltage that the AC source is allowed to be in order for the FX to connect to that source. The FX will back off the charger if the AC source is at this lower limit. If the AC source falls below this limit, the FX will disconnect from the AC source until it is above this value. This setting has a range between 80 vac and 220 vac in 2 vac increments.

The **AC1/GRID UPPER LIMIT** set point allows adjustment of the maximum voltage that the AC source is allowed to be in order for the FX to connect to that source. If the AC source exceeds this value, the FX will disconnect from the AC source until it is below this value. This setting has a range between 250 vac and 300 vac in 2 vac increments.

The **AC1/GRID INPUT LIMIT** sets the maximum amount of current the FX allows to be drawn from the AC source. When the AC input current limit is reached, the power draw of the battery charger is backed off to prevent overloading the AC source. If the AC loads exceed this limit, the FX will give a warning and start blinking the red "ERROR" LED. This setting has a range between 2.5 aac and 30.0 aac in 0.5 aac increments.

The **AC1/GRID TRANSFER DELAY** is the amount of time that the AC input will remain connected to the AC source when the AC input voltage drops below the AC1/GRID **lower limit** setting. Once the AC voltage has risen above the AC1/GRID **lower limit** setting for the AC INPUT CONNECT DELAY time period the AC source will be reconnected. This setting has a range between 0 cycles and 240 cycles in 1 cycle increments.

Selecting TOP returns the user to the top of the ADV/FX/GRID menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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GENERATOR MENU

The **GEN** (generator) category of the advanced menu section allows for adjustment of the AC input voltage window and time delays to match the characteristics of the AC source if that AC source is a generator. This setting can be found in the SETUP/FX/INPUT menu. All OutBack Power System FX's other than the "Grid-Tie" FX's have a default of GEN (generator) as the AC source.

```
ADV-----------------
choose product:

FX              MATE
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting **<FX>** allows adjustment of the FX's advanced programming.

```
ADV/FX/PAGE1--------
choose category:

ADV  INV   CHGR  PG2
```

Selecting **<PG2>** advances the user to the second page of the advanced menu.

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID   GEN  PG3
```

Selecting **<GEN>** allows adjustment of the AC input set points and operation.

```
ADV/FX/GEN-------P00
ac input    00.5 min
connect delay
DOWN  INC  DEC  PORT
```

The **AC INPUT CONNECT DELAY** set point adjusts the time period of when the FX sees an acceptable AC source to when it connects the AC loads to that source. This is useful to allow a generator to warm up. This setting has a range between 0.2 minutes to 15 minutes in 0.1 minute increments.

```
ADV/FX/GEN-------P00
ac2/gen      208 vac
lower limit
DOWN  INC  DEC  PORT
```

The **AC2/GEN LOWER LIMIT** set point allows adjustment of the minimum voltage that the AC source is allowed to be in order for the FX to connect to that source. The FX will back off the charger if the AC source is at this lower limit. If the AC source falls below this limit, the FX will disconnect from the AC source until it is above this value. This setting has a range between 80 vac and 220 vac in 2 vac increments.

```
ADV/FX/GEN-------P00
ac2/gen      270 vac
upper limit
DOWN  INC  DEC  PORT
```

The **AC2/GEN UPPER LIMIT** set point allows adjustment of the maximum voltage that the AC source is allowed to be in order for the FX to connect to that source. If the AC source exceeds this value, the FX will disconnect from the AC source until it is below this value. This setting has a range between 250 vac and 300 vac in 2 vac increments.

```
ADV/FX/GEN-------P00
ac2/gen     24.0 aac
input limit
DOWN  INC  DEC  PORT
```

The **AC2/GEN INPUT LIMIT** sets the maximum amount of current the FX allows to be drawn from the AC source. When the AC input current limit is reached, the power draw of the battery charger is backed off to prevent overloading the AC source. If the AC loads exceed this limit, the FX will give a warning and start blinking the red "ERROR" LED. This setting has a range between 2.5 aac and 30.0 aac in 0.5 aac increments.

```
ADV/FX/GEN-------P00
ac2/gen    60 cycles
transfer delay
DOWN  INC  DEC  PORT
```

The **AC2/GEN TRANSFER DELAY** is the amount of time that the AC input will remain connected to the AC source when the AC input voltage drops below the AC1/GEN **lower limit** setting. Once the AC voltage has risen above the AC1/GEN **lower limit** setting for the AC INPUT CONNECT DELAY time period the AC source will be reconnected. This setting has a range between 0 cycles and 240cycles in 1 cycle increments.

```
ADV/FX/GEN-------P00
ac2/gen
support
DOWN  OFF   ON  PORT
```

The **AC2/GEN SUPPORT** setting allows the FX to assist the generator for very large AC loads or if the generator's continuous power is less than the continuous power of the FX and the loads are drawing more power than the generator can give. For this feature to work properly, the generator must have a steady AC voltage that the FX can track. Otherwise, the FX cannot sync to the generator. This feature is not yet available for "Export" FX's.

```
ADV/FX/GEN----------
  GEN programming
    completed
     TOP   ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/GEN menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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AUXILIARY MENU

The **AUX** (auxiliary) section can be used to control external AC or DC loads, signal a generator start system, send a fault alarm signal, or to run a fan. The AUX output provides a 12 vdc, 0.7 adc output on the AUX terminals located in the AC wiring compartment.

```
ADV/FX/PAGE1--------
choose category:

ADV  INV   CHGR  PG2
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID   GEN  PG3
```

Selecting **<PG3>** shows a third screen of categories.

```
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
```

Selecting **<AUX>** allows adjustment of the auxiliary output set points and operation. The **AUX OUTPUT CONTROL** screen allows selection of the mode of the AUX output. Selecting INC or DEC changes the mode between OFF, AUTO, and ON. Selecting OFF disables the AUX output from operating. Selecting AUTO allows the AUX output to automatically perform the function that is selected in the **AUX OUTPUT FUNCTION** screens below. Selecting ON forces the AUX output to be kept ON regardless of the function selected. Pressing **<DOWN>** allows the selection of the AUX OUTPUT FUNCTION. There are nine functions in this section. The default setting is "Cool Fan" which is set to run a Turbo Kit without any programming. The function at the top of the menu is "AC Drop". The user must press **<INC>** three times in order to get to the top of the list of functions.

```
ADV/FX/AUX-------P00
aux output      AUTO
control
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output   AC Drop
function
DOWN  INC  DEC  PORT
```

Selecting **AC DROP** enables the AUX output when an AC source is connected to the FX. When the AC source ceases (due to a power outage, or a generator quitting) the Aux output will be deactivated. This allows the user to attach an indicator to the AUX output to show the user when an AC source is connected.

```
ADV/FX/AUX-------P00
aux output  DivertAC
function
DOWN  INC  DEC  PORT
```

Selecting **DIVERT** enables the AUX output to function as a diversion controller. This can be used to send excess power from a renewable energy source to a load. This can allow control of sources such as wind turbines or hydro-generators. Two choices of DIVERT are provided – 'DivertDC' and 'DivertAC'. 'DivertDC' is used to divert power to DC loads and 'DivertAC' is used to divert power to AC loads. The only difference is that the 'DivertAC' setting will turn off the AUX output if the inverter is overloaded. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-------P00
aux output  DivertDC
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  Cool Fan
function
DOWN  INC  DEC  PORT
```

Selecting **COOLFAN** (default) enables the AUX output to function as a thermostatically operated ventilation system controller. When the FX approaches an over temperature condition, the AUX output will be energized. This can be used to power a small 12 vdc brushless "muffin" type fan, the Turbo Kit, or can be used to control a larger cooling fan via a 12 vdc coil relay.

```
ADV/FX/AUX-------P00
aux output  Vent Fan
function
DOWN  INC  DEC  PORT
```

Selecting **VENTFAN** enables the AUX output to function as an automatic battery ventilation system controller. The AUX output can provide 0.7 amps of power for connection to a 12 vdc brushless "muffin" type fan. The fan will be automatically turned on when the voltage exceeds the VENTFAN ON voltage set point. The fan can be set to operate intermittently by adjusting the VENTFAN OFF TIME PERIOD. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-------P00
aux output     Fault
function
DOWN  INC  DEC  PORT
```

Selecting **FAULT** enables the AUX output to function as an alarm output. When the FX enters any of the error conditions, the AUX output is energized. This can be used to send an alarm signal via radio, pager or telephone dialer. It also can be used to log error conditions by using it to trigger an event recording device.

```
ADV/FX/AUX-------P00
aux output  GenAlert
function
DOWN  INC  DEC  PORT
```

Selecting **GENALERT** enables the AUX output to function as a simple voltage controlled generator start signal. 'GenAlert' can be used to "alert" the system user to start the generator due to the battery voltage being low. Only connection to a 2-wire type generator is possible and must be done through a 12 volt DC relay. Time delays for ON and OFF are adjustable. Using 'Advanced Generator Start' (AGS) will override any AUX function that is programmed. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-------P00
aux output  LoadShed
function
DOWN  INC  DEC  PORT
```

Selecting **LOADSHED** enables the AUX output to function as a load management system. When the battery voltage drops below the LOAD DISCONNECT set point for more than 3 seconds, the AUX output is energized. Connecting a normally closed (NC) relay to the circuitry of non-vital loads will disengage them with this function. LOADSHED will also occur when the FX approaches an over-temperature condition or when the AC output voltage drops below 202 vac for more than 3 seconds. There is a 3-minute fixed delay before the AUX output is de-energized. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-------P00
aux output    Remote
function
DOWN  INC  DEC  PORT
```

Selecting **REMOTE** enables the AUX output to be controlled by the MATE or a PC computer connected to the MATE PC communication port. This function is currently not operational. It will be operational in the future.

Press **<DOWN>** after selecting the AUX OUTPUT FUNCTION of your choice. The AUX menu section is continued on the following page.

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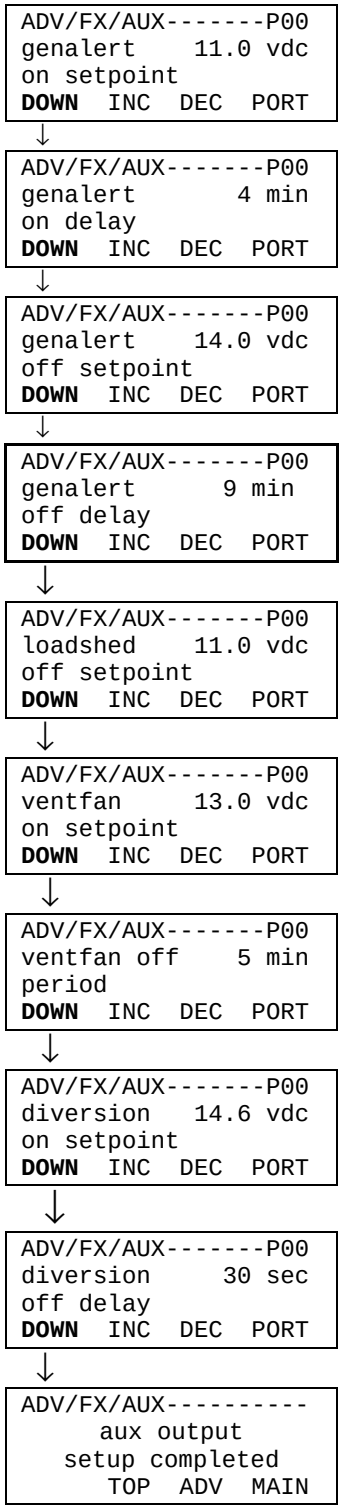
AUXILIARY MENU (CONTINUED)

This page contains to settings for the various functions that can be chosen in the AUX OUTPUT FUNCTION screen described on the previous page. There are voltage and time period settings for 'GenAlert', 'LoadShed', 'VentFan', and 'Diversion'.

The following displays allow the adjustment of the particular AUX OUTPUT FUNCTION that was selected on the previous screen in the AUX menu section.



The **GENALERT ON SET POINT** is the battery voltage at which the AUX output is energized when the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 10.0 vdc and 14.0 vdc in 0.1 vdc increments.

The **GENALERT ON DELAY** is the amount of time that the battery voltage must remain below the GENALERT ON SETPOINT voltage for the AUX output to become energized. This setting is provided to allow for short periods of heavy load usage. This setting has a range between 0 minutes and 240 minutes in 1 minute increments.

The **GENALERT OFF SETPOINT** is the battery voltage at which the AUX output is de-energized when the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 12.0 vdc and 18.0 vdc in 0.1 vdc increments.

The **GENALERT OFF DELAY** set point is the amount of time that the battery voltage must remain above the GENALERT OFF SETPOINT voltage set point for the AUX output to become de-energized. This setting is provided to allow the battery charger to more fully recharge the battery once it has been started. This setting has a range between 0 minutes and 240 minutes in 1 minute increments.

The **LOADSHED OFF SETPOINT** is the battery voltage at which the AUX output is energized to reduce the load on the inverter and battery system. Once the battery voltage has dropped below this setting for 3 seconds the AUX output will have 12 vdc available to power a DC coil relay to disconnect an AC load. Once the LOADSHED function has been triggered it will remain on for a minimum of 3 minutes. This setting has a range between 10.0 vdc and 14.0 vdc in 0.1 vdc increments.

The **VENTFAN ON SETPOINT** is the battery voltage at which the AUX output is energized when the AUX OUTPUT FUNCTION has been set to VENTFAN. The AUX output can be used to keep hydrogen from accumulating by exchanging the air in the battery enclosure. This setting has a range between 10.0 vdc and 16.0 vdc in 0.1 vdc increments.

The **VENTFAN OFF PERIOD** set point can be used to allow for intermittent operation of the battery enclosure ventilation system. Setting the time period to 5 minutes will operate the fan at a 50% duty cycle as the "on" time period is fixed at 5 minutes. Setting the VENTFAN OFF PERIOD to zero will keep the fan on continuously when the battery voltage exceeds the VENTFAN ON voltage set point. This setting has a range between 0 minutes and 30 minutes in 1 minute increments.

The **DIVERSION ON SETPOINT** enables the AUX output to function as a diversion controller. This can be used to send excess power from a renewable energy source to a load. This can allow control of sources such as wind turbines or hydro-generators. Two types of DIVERT are selectable – DIVERTDC and DIVERTAC. The only difference is that the AC diversion setting will quickly turn off the AUX output if the FX is overloaded. This setting has a range between 12.0 vdc and 16.0 vdc in 0.1 vdc increments.

The **DIVERSION OFF DELAY** is the amount of time that the AUX output will continue to be energized after the battery voltage falls below the DIVERSION ON SETPOINT voltage. In cases where the battery voltage is hovering around the DIVERSION ON SETPOINT voltage, the AUX output won't flicker. This setting has a range between 0 seconds and 240 seconds in 1 second increments.

Selecting TOP returns the user to the top of the ADV/FX/AUX menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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STACKING MENU

The **STACK** (stacking) section is used to program the stacking of the FX's as well as which 'Slave' FX's will stay ON at all times (won't go into 'Power Save' mode) and in what order the slave FX's will come ON (if they are in 'Power Save' mode). An explanation of stacking can be found on pages 24-26 of this manual.

```
ADV/FX/PAGE1--------
choose category:

ADV  INV   CHGR  PG2
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID   GEN  PG3
```

Selecting **<PG3>** shows a third screen of categories.

```
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
```

Selecting **<STACK>** allows adjustment of the stacking set points and operation.

```
ADV/FX/STACK-----P00
Stack 1-2ph Master
phase
DOWN  INC  DEC  PORT
```

The **STACK PHASE** screen sets the hierarchy of the FX's. If the system is to be stacked, a HUB must be included and the FX that is to be the MASTER must be plugged into port 1 of the HUB. The default for every FX is '1-2ph Master'. Pressing PORT will select the next port that an FX is plugged into. When the port for the slave FX has been chosen, press INC to cycle through the slave options (Classic Slave, OB Slave L1, OB Slave L2, 3ph Master, and 3ph Slave).

```
ADV/FX/STACK-----P00
power save level   0
master adjust only
DOWN  INC  DEC  PORT
```

The **POWER SAVE LEVEL MASTER ADJUST** is used to set the number of FX SLAVE's that will remain on under any load condition. The value corresponds to the rank of the SLAVE. For example, setting this value to 2 allows all slaves with POWER SAVE LEVEL SLAVE ADJUST ONLY values 2 or less to stay on at all times. Setting this number to a low value will result in fewer FX's remaining on and will provide the highest system efficiency.

```
ADV/FX/STACK-----P00
power save level   1
slave adjust only
DOWN  INC  DEC  PORT
```

The **POWER SAVE LEVEL SLAVE ADJUST** is used to set a slave FX's priority for operation when the complete system is operating at medium to heavy loads. By setting each of the slaves to a different number you can control the sequence that the slave FX's are turned on by the master FX.

```
ADV/FX/STACK--------
  stacking setup
     completed
      TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/STACK menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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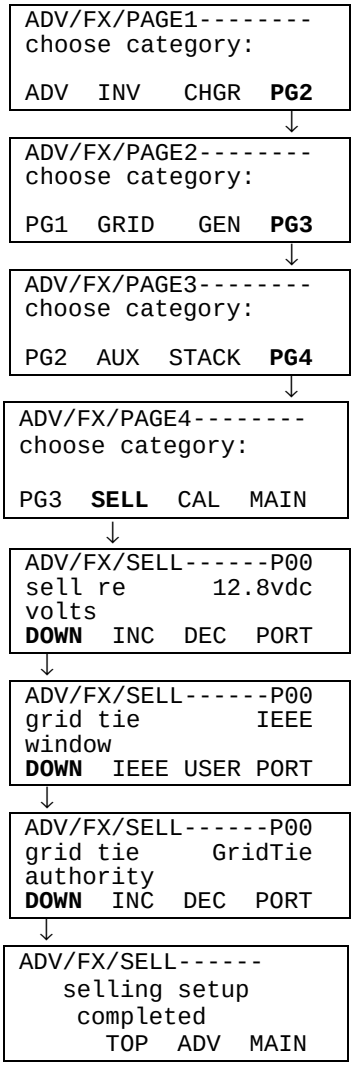
SELL MENU

The **SELL** section is used to set the functions that control the process of selling power back to the utility grid. This menu is only operational for Grid-Tie FX's and is not operational with "Export" FX's at this time. These functions include setting the voltage at which the FX sells back to the utility grid, setting the window in which the Grid-Tie function operates, and to enable or disable the Grid-Tie function. The default values enable the Grid-Tie FX to sell back to the utility grid after the FX has completed a charge cycle. To disable this charge cycle, press the **<AC IN>** "hot" button four times, press **<BULK>**, press **<STOP>** and then press **<OK>**. The FX waits 5 minutes after it has accepted the utility grid as an AC source and must be above the "sell RE volts" (found in this menu) to start selling.



Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

Selecting **<PG3>** shows a third screen of categories.

Selecting **<PG4>** shows a fourth screen of categories.

Selecting **<SELL>** allows adjustment of the Grid-tie and selling set points and operation.

The **SELL RE VOLTS** (RE = Renewable Energy) screen allows the user to set the voltage at which they would like to sell battery power back to the utility grid. If the battery voltage is above the voltage shown on this screen and the FX isn't charging then the FX will sell power back to the utility grid. This setting has a range between 10.0 vdc and 15.0 vdc in 0.1vdc increments.

The **GRID TIE WINDOW** screen controls the voltage and frequency windows that the grid-tie function operates in. If the FX repeatedly disconnects from the utility grid this value may need to be changed. This function **should not**, I repeat, **should not** be changed without consulting OutBack Power Systems first.

The **GRID TIE AUTHORITY** screen allows the user to turn on or off the selling function of the FX. When the screen displays "GridTie" (default), the FX will sell power under the correct conditions. Pressing DEC will change "GridTie" to "No Sell" and the selling function will be disabled. Pressing INC will change the display back from "No Sell" to "GridTie".

Selecting TOP returns the user to the top of the ADV/FX/SELL menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

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CALIBRATION MENU

The **CAL** (calibration) section is used in the factory or field to make fine adjustments in the operation of the FX. It is particularly useful when multiple FX's are connected together in the different stacking configurations to maximize the performance of the FX's.

In most cases, the user will not need to adjust these settings from the factory default values.

```
ADV/FX/PAGE1--------
choose category:

ADV  INV   CHGR  PG2
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID   GEN  PG3
```

Selecting **<PG3>** shows a third screen of categories.

```
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
```

Selecting **<PG4>** shows a fourth screen of categories.

```
ADV/FX/PAGE4--------
choose category:

PG3  SELL  CAL  MAIN
```

Selecting **<CAL>** allows calibration of the AC input, AC output, and battery voltage set points.

```
ADV/FX/CALIBRATE-P00
vac input    230 vac
adjustment
DOWN  INC  DEC  PORT
```

The **VAC INPUT ADJUSTMENT** allows calibration of the AC input voltage. If the AC source is measured and is different than the value read from the MATE, the user can adjust the reading to match the measured value. This value can be raised by pressing the INC button. Conversely, this value can be lowered by pressing the DEC button. The value can be raised or lowered 4 vac.

```
ADV/FX/CALIBRATE-P00
vac output   230 vac
adjustment
DOWN  INC  DEC  PORT
```

The **VAC OUTPUT ADJUSTMENT** allows calibration of the AC output voltage. If the AC output is measured and is different than the value read from the MATE, the user can adjust the reading to match the measured value. This value can be raised up to 4 vac by pressing the INC button and lowered up to 4 vac by pressing the DEC button. NOTE: Only affects MATE's voltage display - See page 47 [ADJ. OUTPUT VOLTAGE] for actual adjustment of inverter VAC output.

```
ADV/FX/CALIBRATE-P00
battery vdc 12.8 vdc
adjustment
DOWN  INC  DEC  PORT
```

The **BATTERY VDC ADJUSTMENT** allows calibration of the battery voltage. If the battery voltage is measured and is different than the value read from the MATE, the user can adjust the reading to match the measured value. This value can be raised by pressing the INC button. Conversely, this value can be lowered by pressing the DEC button. The value can be raised or lowered 0.2 vdc.

```
ADV/FX/CALIBRATION--
  calibration setup
      completed
     TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/CALIBRATION menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

END OF ADVANCED MENU SYSTEM

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The following chart contains information on wire sizes, the DC resistance of the wires and the corresponding diameters and areas of these wires. This information can be used to calculate the voltage drop of the wires or to find an equivalent wire size.

SIZE (AWG)	DC Resistance in Ohms (1000 feet)	CROSS-SECTIONAL AREA		APPROXIMATE DIAMETER	
		SQUARE INCHES	SQUARE MILLIMETERS	INCHES	MILLIMETERS
14	3.14	.0032	2.08	.078	1.98
12	1.98	.0051	3.31	.101	2.57
10	1.24	.0082	5.26	.126	3.20
8	0.78	.0130	8.37	.162	4.11
6	0.50	.0206	13.30	.215	5.46
4	0.31	.0328	21.15	.269	6.83
2	0.19	.0521	33.62	.337	8.56
1	0.15	.0657	42.41	.376	9.55
1/0	0.12	.0829	53.50	.423	10.74
2/0	0.10	.1045	67.43	.508	12.90
3/0	0.08	.1318	85.01	.576	14.63
4/0	0.06	.1662	107.20	.645	16.38

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OutBack Power Systems

Two Year Limited Warranty

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The limited warranty is extended to the original user and is transferable. The limited warranty term begins on the date of invoice to the original user of the product. The limited warranty does not apply to any product or part thereof damaged by a) alteration or disassembly, b) accident or abuse, c) corrosion, d) lightning, e) reverse polarity, f) repair or service provided by an unauthorized repair facility, g) operation or installation contrary to instructions pertaining to the product.

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During the two year period beginning on the invoice date, OutBack Power Systems will repair or replace products covered under this limited warranty that are returned to OutBack Power Systems' facility or to an OutBack Power Systems authorized repair facility, or that are repaired on site by an OutBack Power Systems authorized repair technician. To request limited warranty service, you must contact OutBack Power Systems at 360-435-6030 within the limited warranty period. If limited warranty service is required, OutBack Power Systems will issue a Return Material Authorization (RMA) Number. Mark the outside of the package with the RMA number and include a copy of the purchase invoice in the package. You must ship the products back to OutBack Power Systems in their original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. OutBack Power Systems will ship the repaired or replacement products to you freight prepaid if you use an address in the continental United States, where applicable. Shipments to other locations will be made freight collect.

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Please take a moment to register and provide us with some important information.

Name: _____

Address: _____

City, State, Zip Code: _____

Country: _____

Telephone Number: _____

E-mail: _____

Sold by: _____

Installer: _____

Purchase Date: _____

Model Number:_____

Serial Number: _____

Circle all that apply:

Off-Grid Installation	Residential Installation	North America Location
Utility Connected Installation	Commercial Installation	Other _____

_____

Extended Warranty Application

OutBack Power Systems offers an optional three year extension to the standard two year limited warranty. Purchase of extended warranty coverage is available on products listed below provided conditions shown are met. Extended warranty coverage must be purchased within 90 days of the original sale of the product covered.

PRODUCT	REQUIRED SURGE PROTECTION	EXTENDED WARRANTY COST
Any FX Series Inverter/Charger	AC Input; AC Output, DC Input	$300.00
MX60	DC Input; DC Output	$100.00
MATE	NA	$50.00
HUB 4	NA	$35.00
HUB 10	NA	$50.00

Product Covered	**Serial Number**	**Quantity**	**Extended Warranty Cost**

Total _____

Send check or money order payable to OutBack Power Systems. Include a completed copy of this application and send to:

OutBack Power Systems
Extended Warranty Program
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